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SHOP PRACTICE

Producing Hollow Steel Aircraft Propeller Blades — *By George H. DeGroat* — 137
Hot-Joggling Aluminum Extrusions — *By Thomas E. Piper* — 144
Some New Concepts in Bending — *By Ralph M. Shaw, Jr.* — 149
Precision Form-Grinding of Punches and Dies — *By George H. DeGroat* — 159
Tracer-Controlled Milling Machines Employed for Repetitive Work — 170
Forming Washing Machine Legs on a Transfer Type Press — *By A. E. Sweet* — 177

MACHINE AND TOOL DESIGN

Design of Worm-Gear Hobs — *By F. G. Watts and R. D. Silversides* — 154
Constructing Arcs Tangent to Circles — *By W. W. Quist* — 185
Mechanism that Produces Variable Speed from Constant Rotary Motion — *By L. Kasper* — 187
Vise Adapter for Milling Slots in Two Parts at One Set-up — *By A. C. Eagle* — 189
Quick-Acting Fixture for Holding Small Bushings — *By Irving Mansfield* — 190
Welded Construction Simplifies Jig for Drilling Irregular Casting — *By Robert Mawson* — 190
Gage that Insures Accurate Grinding of Combination Drill — *By Walter Gabriel* — 192
Gage for Setting Inserted Blades of Milling Cutters to Proper Depth — *By Irving Mansfield* — 193
Fixture that Insures Accurate Alignment in Hand Tapping Operations — *By John Homewood* — 193
American Standard Taper Pipe Threads (Data Sheet) — 235

MANAGEMENT PROBLEMS

Do Machines Throw Men Out of Work? — *By Charles O. Herb* — 153
Defense-Program Problems Discussed by Machine Tool Builders at Toronto — 166
Selling Problems Discussed by Machine Tool Distributors — 175
The Sales Engineer and His Problems — Make Friends with Other Sales Engineers — *By Bernard Lester* — 196

DEPARTMENTS

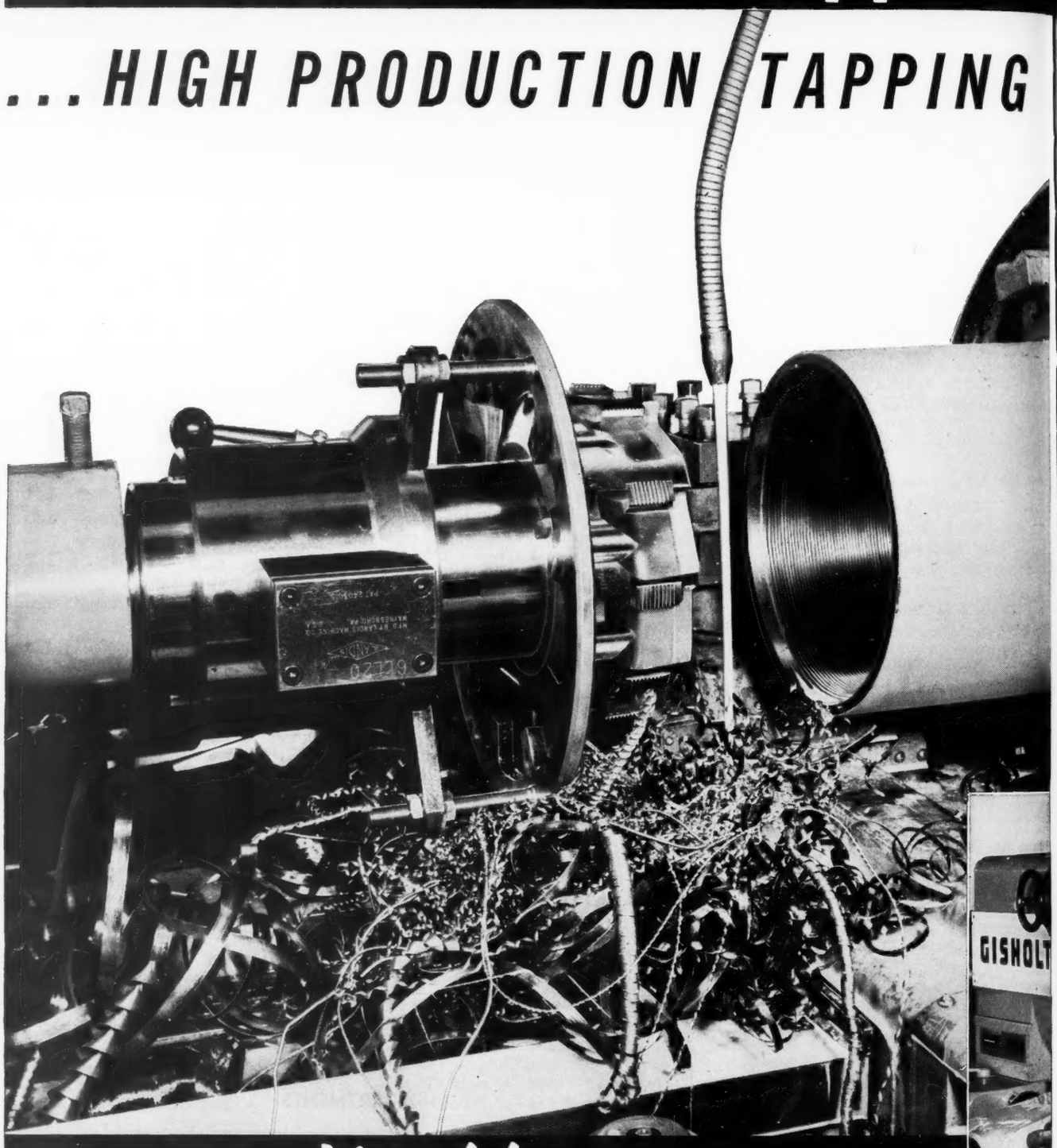
Engineering News — 169
Materials of Industry — 182
Ingenious Mechanisms — 187
Tool Engineering Ideas — 189
Ideas for Shop and Drafting-Room — 193
Questions and Answers — 194
The Sales Engineer — 196
Shop Equipment News — 197
Between Grinds — 229
News of Industry — 230
Data Sheet — 235

Product Index 327-365

Advertisers Index 367-368

Internal Threads Tapped

...HIGH PRODUCTION TAPPING



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MACHINERY
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Producing Hollow Steel Aircraft Propeller Blades

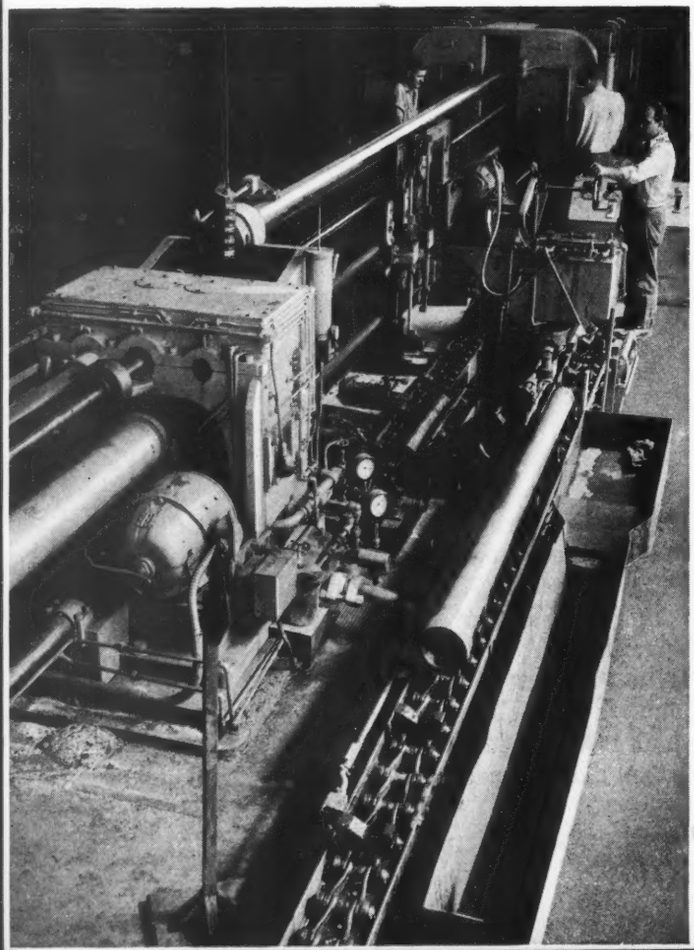
By GEORGE H. DeGROAT

SINCE the end of World War II, intensive efforts have been made to improve the design of aircraft propellers in order to achieve greater efficiency in high-speed flight. With the rapid developments in turbo-prop engines and increased power in piston engines, propeller designers are more than ever concerned with attaining the objectives of maximum strength and lightness combined with increased size; propeller control interrelated with control of the engine; and maximum thrust at selected speeds.

As the result of considerable research and experimentation at Hamilton Standard Division, United Aircraft Corporation, East Hartford, Conn., a propeller design has been developed which is a refinement of the basic square-tipped, rectangular shaped, Hamilton Standard hollow

Fig. 1. Cores which provide most of the structural strength in a hollow blade are internally honed to a surface finish of 16 to 20 micro-inches

Fig. 2. Cores are cold taper-rolled in a specially built machine, which is 90 feet long



steel blade propeller now in operation on commercial and military aircraft. Experimental propellers of the new design have operated in wind tunnel tests with efficiencies approximating 80 per cent at aircraft speeds as high as 600 miles per hour at sea level, and it is believed that they can be made to operate efficiently at speeds up to and beyond that of sound.

The standard production hollow blades contain two principal members—a core or spar that provides most of the structural strength, and a shell in the form of an airfoil sheath over the core. The cores are made of high-alloy steel seamless-tube forgings, some of which are over 40 inches long and weigh approximately 170 pounds. After reducing the length to 36 inches to insure the soundness of structure at the ends, the cores are turned, bored, internally threaded, and ground. To facilitate the cold-reducing operations that follow, the outside diameter is ground and polished to a surface finish of 20 micro-inches, r.m.s.

The bore is honed in a horizontal machine built by the Barnes Drill Co. to a surface finish ranging between 16 and 20 micro-inches, r.m.s. As may be seen at the left in Fig. 1, this machine is equipped with a loading fixture which swings about the center axis of the machine to bring the reloaded station into the honing position, so that a core can be loaded while the honing operation is being performed.

Following an annealing operation, the cores are cold taper-reduced in the 90-foot machine illustrated in Fig. 2. Built especially for this work by the Tube Reducing Corporation, this machine employs a conveyor that carries a core to the loading station, where it is automatically screwed onto a mandrel, internal threads having been previously machined at the hub end. The core is then passed between a pair of semicircular, taper grooved dies that rock back and forth over the work, compressing the metal against the mandrel, which controls the inside diameter. The mandrel is chrome-plated to prevent galling. Each time the core passes through the dies, it is indexed to distribute the cold-working effect over the entire circumference.

When the core has reached a predetermined length, the dies are changed and the operation repeated to obtain further reduction and elongation. Three such passes are made, the cores being annealed between each one. In the case of cores for propellers 16 feet in diameter, such as those used on the Boeing B-29 and the "Stratocruiser,"

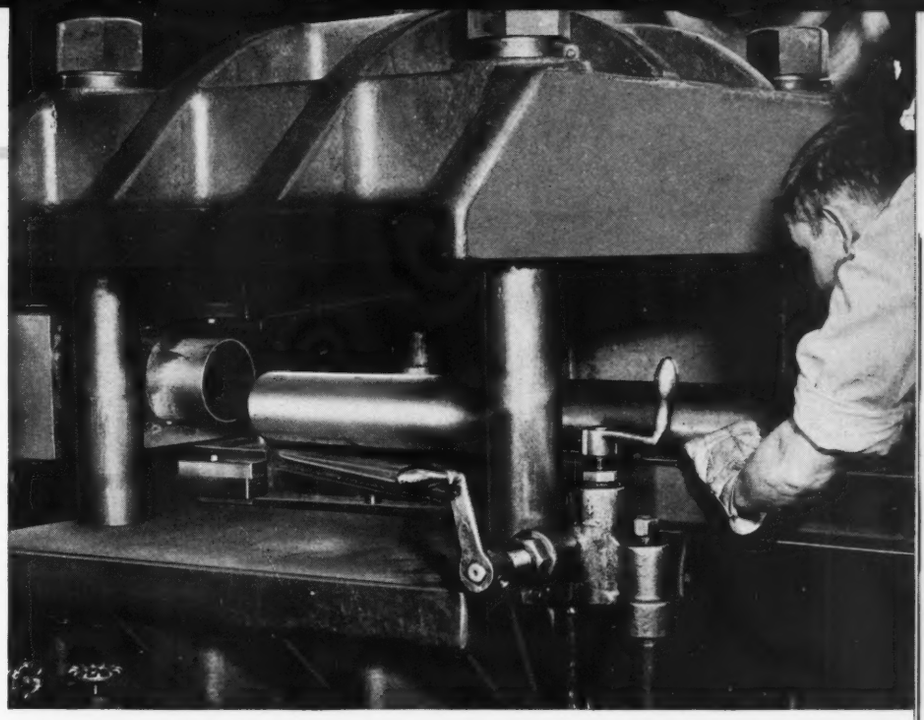


Fig. 3. Special electric furnaces, located adjacent to presses containing crimping dies, are employed to heat the tips of cores before the crimping operation

cores 3 feet long are elongated to 8 feet, the wall thickness being reduced at the same time to approximately one-thirteenth the original size. Employing a rate of 56 strokes per minute, about 2 1/4 minutes is required for the first and third passes and 2 1/2 minutes for the second.

Following the cold taper-reducing operations, the hub ends of the cores are swaged and the tip ends are closed by crimping. The crimping operation is performed by heating the tips and then pressing them between dies. Special electric furnaces adjacent to presses containing the crimping dies are used for heating the work, as shown in Fig. 3. A core that has been completely crimped is shown between the dies in Fig. 4. This operation is followed by hot-forming. Before describing the hot-forming operation on the cores, a brief description will be given of the work performed on the shells before they, too, are ready for hot-forming.

The shells, made of high-alloy sheet steel, are given a rough airfoil shape in three steps. These consist of stretching or stamping to give the required contour to the two main surfaces; folding to produce the leading edge; and cold-forming to close the airfoil before seam-welding the open edges. For experimental work, stretching is preferred to stamping, and is accomplished on the Sheridan hydraulic stretch press shown in Fig. 5. The jaws of this machine grip the ends of the sheet, twist it, and pull it over form blocks.

The leading edge is formed in the stretched or stamped shell by a steel punch that is forced into a rubber die by the ram of a hydraulic press.

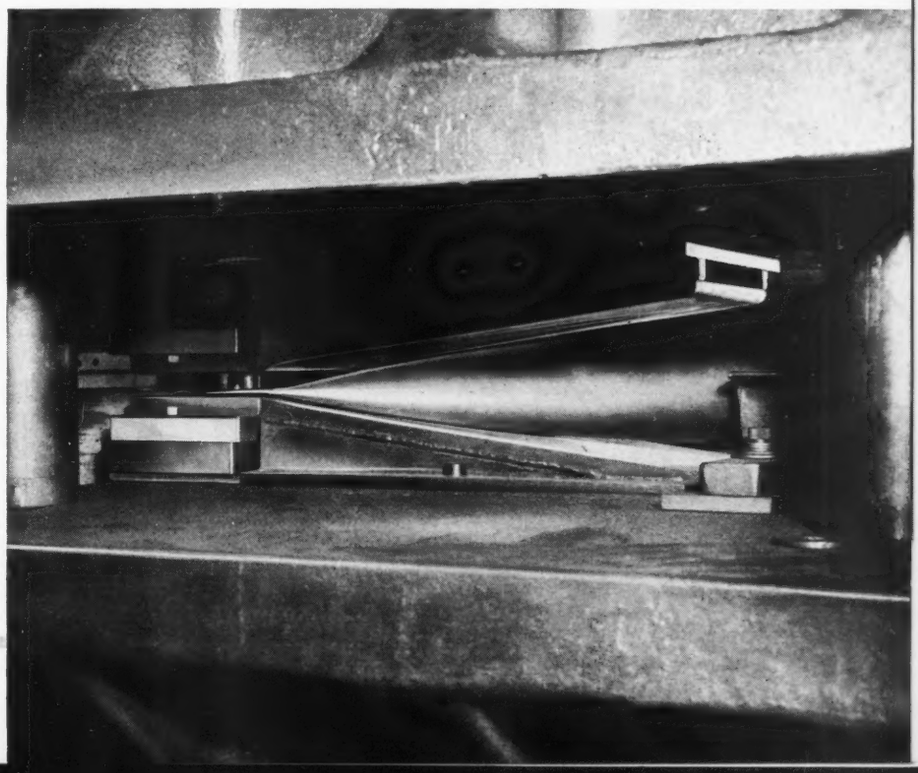


Fig. 4. After being heated in an adjacent furnace, the tip of the core is crimped between dies in a small press, as illustrated

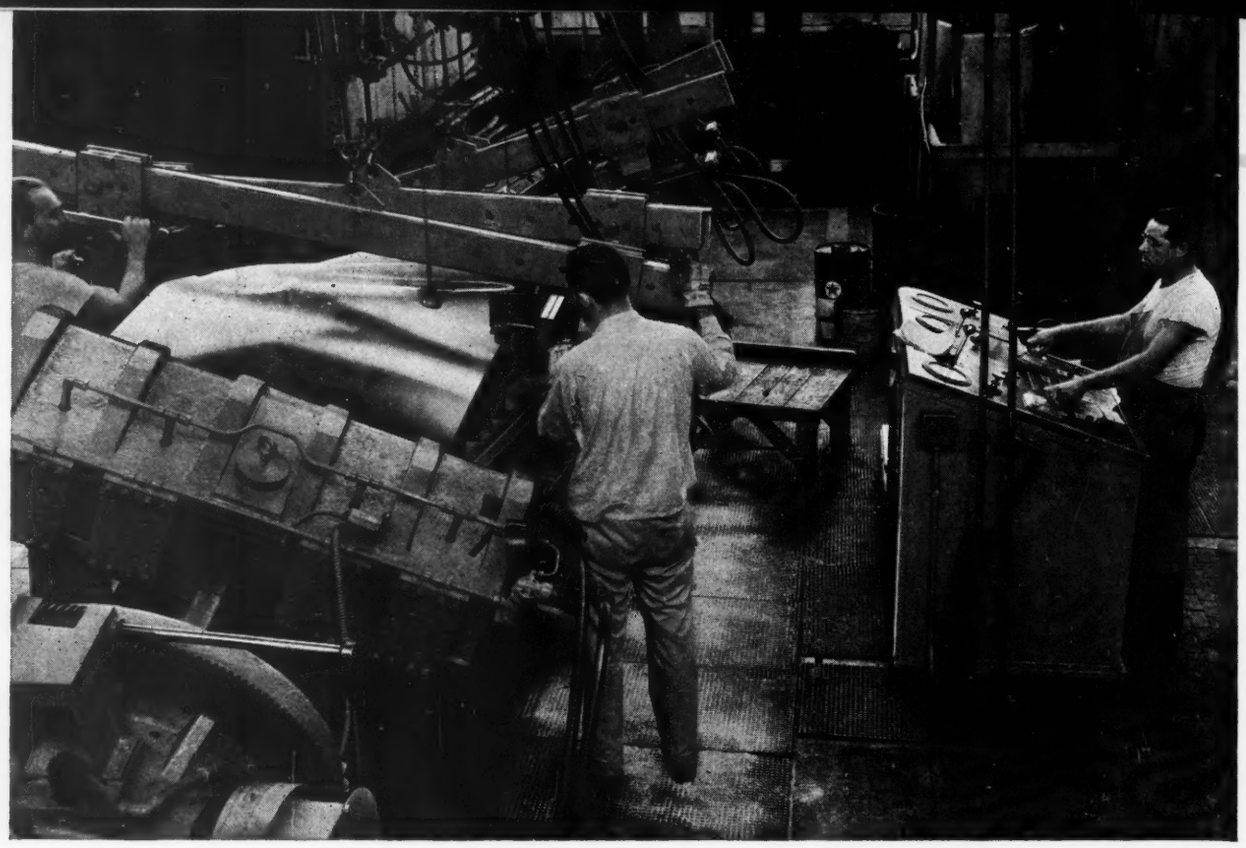


Fig. 5. For special, experimental orders, alloy steel sheet is folded in this stretching machine as one of the first steps in making a shell that forms an airfoil sheath around a core

Of course, the trailing edge must be left open enough to permit the punch to withdraw. The airfoil is closed by holding the material against a properly contoured die by internal pressure applied through a metal bladder. While the shell is held in this manner, the trailing edge is tack-welded, and later, a final seam weld is made, as shown in Fig. 6. A fillet of copper alloy is melted into the leading edge to give greater service life. The shells are then ready for the hot-forming operation, which is substantially the same for both shells and cores.

The installation employed for this work consists of six huge, gas-fired furnaces (built by the Lithium Co.), over each of which is mounted a 500-ton Clearing press, Fig. 7. As shown in Fig. 8, the furnaces are moved under the presses on tracks by means of electrically controlled hy-

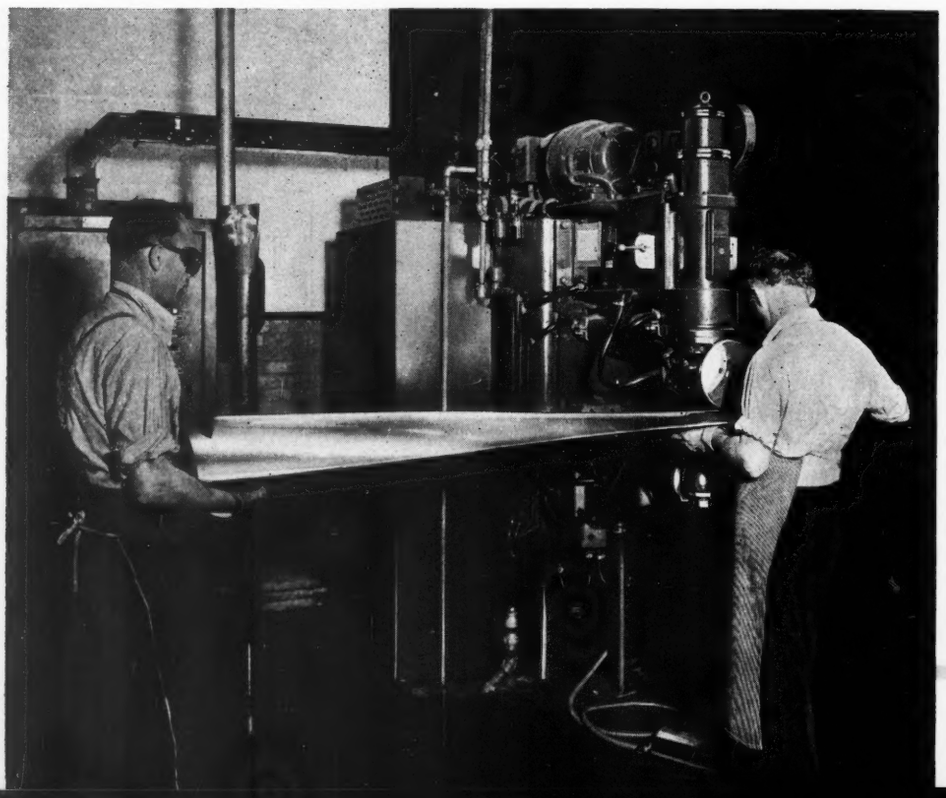


Fig. 6. Seam-welding the edges of the folded shell follows the special stretch-forming operation seen in Fig. 5 or the stamping and cold-forming process employed in production

Fig. 7. Huge furnace-die combinations are used in precision hot-forming hollow blade shells and cores

draulic pressure, each furnace carrying a core, or shell, in a special atmosphere.

When the heating cycle is finished, an air-operated grapple, passing through the press above, engages the work and carries it up to vertical dies in the press. In the case of shells, to produce an airfoil shape, the hot work is placed in the die and gas under pressure is forced into the shell. The outward pressure of the gas and the external resistance of the die combine to force the blade shell into the exact contour of the die. This procedure quenches and hardens the shell at the same time that it produces the desired shape.

Fig. 8. Gas-fired furnaces in the installation illustrated in Fig. 7 are moved on tracks under 500-ton presses by means of electrically controlled hydraulic pressure

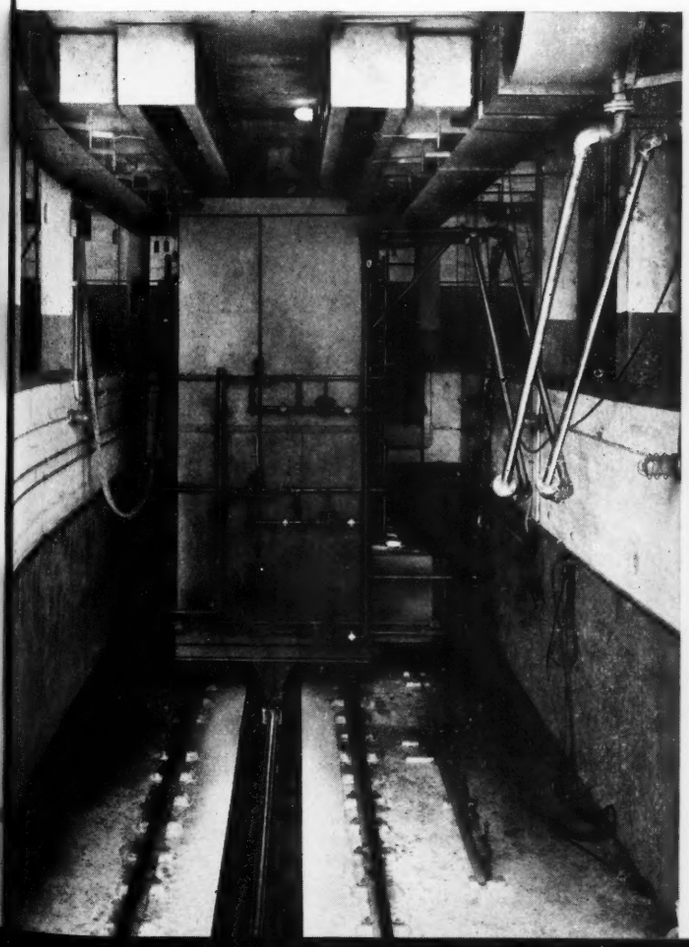
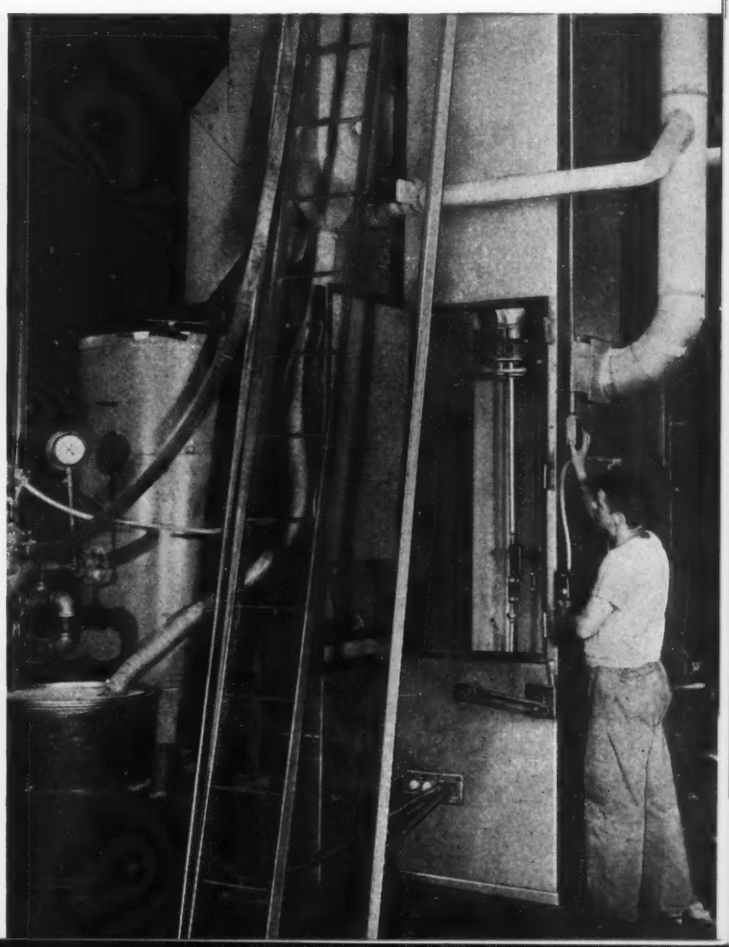


Fig. 9. Machine employed for sand-blasting the interior surfaces of the assembled cores and shells preparatory to applying a corrosion-resistant lacquer



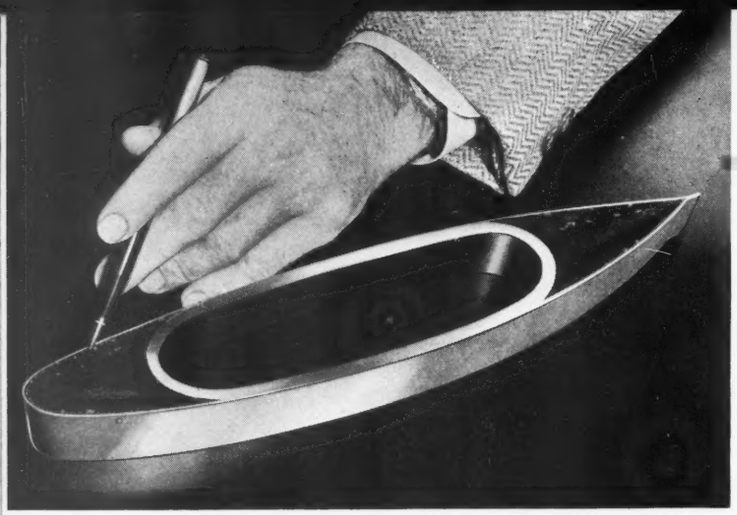


Fig. 10. Cross-section of a hollow steel propeller blade, showing the core, shell, and synthetic rubber which fills the interior cavities

The cores receive almost identical treatment, except that they remain in the furnaces for a longer period of time and are given a special cooling treatment after forming. The formed cores are cooled slowly in chambers near the presses, and, in addition, an air blast quench is employed at the hub end to provide a uniform reduction in temperature. This is required because the wall thickness at this end is greater than at the other end. Carbon restoration is not required during heating, because the core forgings are machined before cold-reducing. Nevertheless, a neutral, protective atmosphere is maintained during the heating of the cores in order to insure that they will retain their maximum fatigue strength.

One of the most difficult problems originally encountered in the manufacture of hollow steel propellers was the joining of the shell to the core. This has been solved by an alloy brazing process using special electric-furnace presses. Strips of alloy foil are placed along the upper and lower surfaces of the core, after which the shell is slipped over the core, so that the alloy strip is the only contact between the two members. This assembly is fitted with a "boot," which carries gas connections, after which it is placed in the furnace press between dies that are similar to those used in the hot-forming operation. Heating the assembly in the dies fuses the alloy and provides a brazed joint for the entire length of the shell and core. In this furnace-press, the assembly is forced against the dies by internal gas pressure, thereby preserving the shape of the hot core and shell. The quality of the joint is assured by electrical examination and by X-ray photographs.

To clean the inner surfaces of the assembled

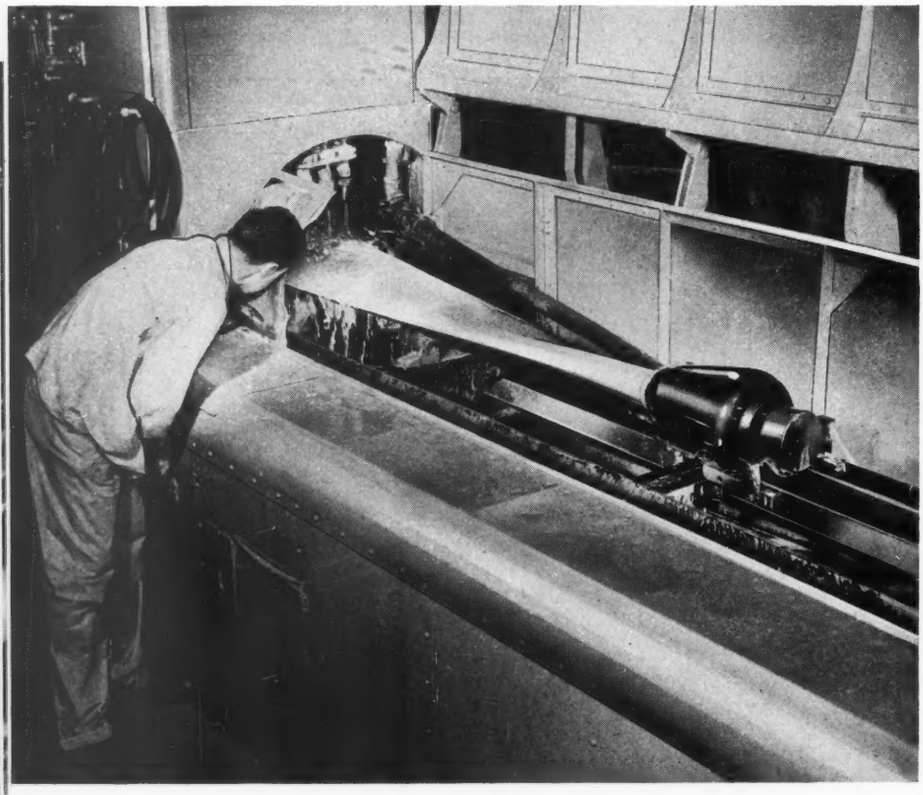


Fig. 11. The external surfaces of assembled hollow steel blades are liquid honed to produce a high surface finish

blade preparatory to applying a corrosion-resistant lacquer, a huge vertical "airblast room," built by the American Wheelabrator & Equipment Corporation, is used, as shown in Fig. 9. The work is loaded on a carriage, or blasting car, which is raised mechanically until the work enters a sand-blasting compartment. The carriage frame then rotates to align the work with this compartment, at which time small rods enter the assembly near the trailing and leading edges and a large rod enters the bore of the core. As the blades move up and down on these rods, sand under 90 pounds per square inch pressure is blasted through holes in the tips of the rods which index during the operation to cover all the internal surfaces.

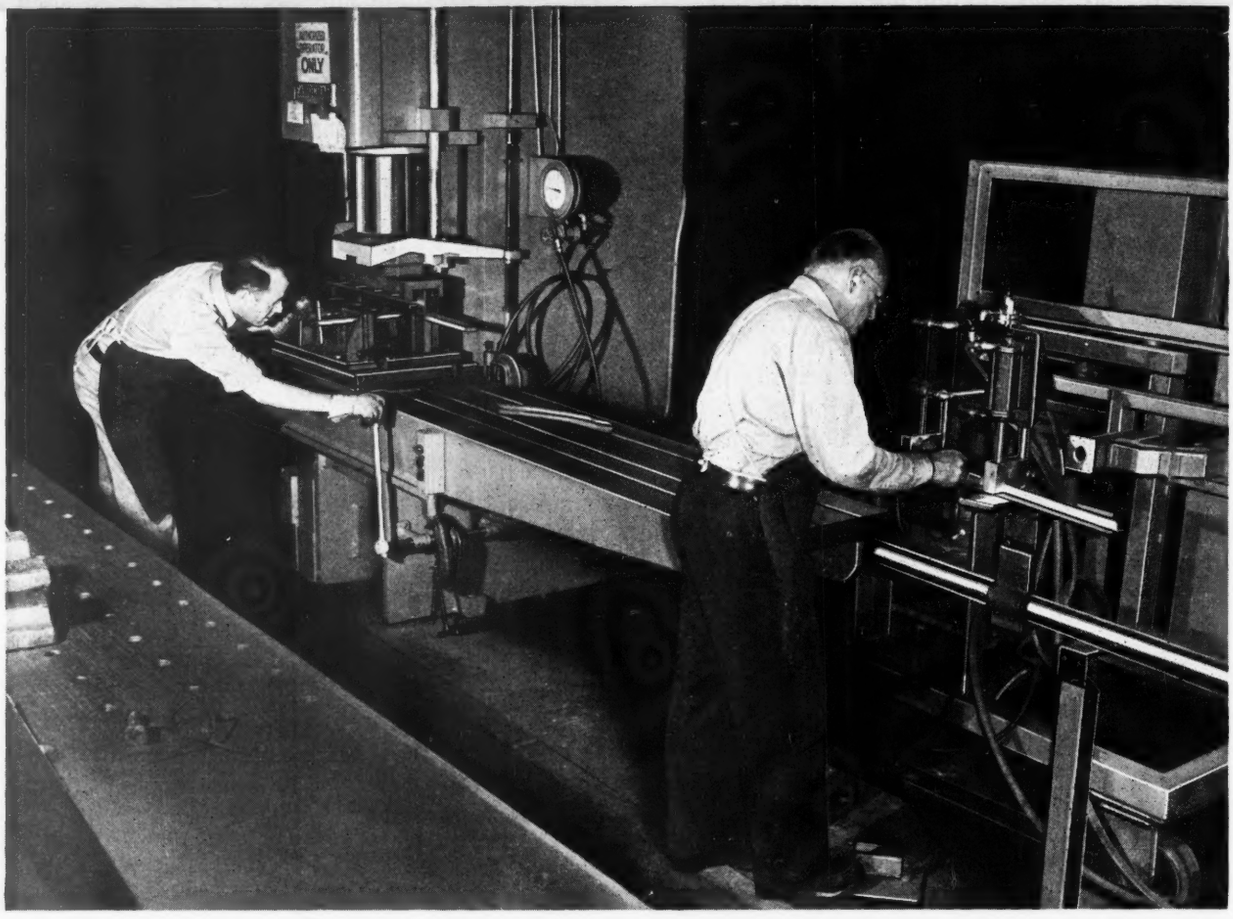
This operation is followed by filling the internal cavities of the assembly with synthetic sponge rubber to stabilize the blade shape and prevent distortion. In this process, rubber strips are inserted in the recesses on both sides of the core, the inside of the shell and core having previously been coated with a corrosion-resistant lacquer. The assembly is then placed in dies and steam-heated to make the rubber foam and fill all air spaces. After the rubber expands, hardens, and cools, it provides a light, rigid material that gives excellent support for the blade shell surfaces. An idea of the construction will be obtained by referring to the cross-sectional cut (Fig. 10) taken near the hub of a propeller, which shows the shell, core, and foam rubber filling.

Among the final operations performed on the assembled hollow steel blades is liquid honing of the external surfaces to obtain a high surface finish. This is done on special machines built by the Vapor Blast Mfg. Co., as seen in Fig. 11.

Milling ball races in the hubs with special formed milling cutters is another late operation in the production line. The ball races are accurately ground to close tolerances, as far as form and location are concerned, on Norton vertical grinders, as shown in Fig. 12. It may be of interest to note that the permissible tolerance on the diameter of each ball is plus or minus 0.000025 inch. Since the temperature of an operator's hand or finger is sufficient to alter the dimensions of a ball beyond this tolerance, a hopper-fed gage is employed to check their accuracy. This high degree of precision insures smoothness of operation, even though a centrifugal force of approximately 60 tons is built up on each blade in flight.

Fig. 12. Grinding bearing races to a high degree of accuracy in the hub of hollow steel propeller blades

Hot-Joggling Aluminum Extrusions



Definite Strides Have Been Made in the Production Forming and Joggling of 75S Aluminum Parts at Elevated Temperatures

By THOMAS E. PIPER, Chief Process Engineer
Northrop Aircraft, Inc., Hawthorne, Calif.

IN the manufacture of "Flying Wings," more than two hundred 75S-T6 aluminum components were formed or "joggled" on hydraulic or mechanical presses after being heated to elevated temperatures. This practice proved so advantageous that Northrop Aircraft, Inc., is now applying it on a production basis in making aluminum parts for all types of airplanes built by the concern. Before standardizing on the heating methods, extensive tests were conducted on both the oil bath and electrical resistance methods. The results of these tests and the details of the heating methods are described here.

Approximately 50 per cent of all production parts that are hot formed or joggled are heated by the oil bath method. Two portable oil bath units constructed especially for this work may be seen at the left of the press in Fig. 2 and at the right of the press in Fig. 3. In tests conducted on the oil bath heating method, studies were made to determine (1) the effect of the length of time for which the work is heated at a given temperature on the mechanical properties of the extrusion; (2) the time required for heat to penetrate given thicknesses of extrusions; (3) the effect of the soaking time on springback

after joggling operations; and (4) the springback allowance to be specified for hot-joggled extrusions.

Experiments showed that a temperature of about 300 degrees F. was most suitable for the hot-joggling of 75S-T6 aluminum extrusions. The effect of the length of the heating period at this temperature is negligible, as only a slight loss in mechanical properties occurs, even if the work is held at 300 degrees F. for as long as four hours. Tests were conducted on material 0.063 and 0.125 inch thick, and the greatest loss in tensile strength amounted to 4000 pounds per square inch; however, the tensile strength was higher by 6000 pounds per square inch than the minimum specifications. Since there is a loss in mechanical properties, it was decided that the total soaking time should not exceed one hour. In general, this length of soaking time will be found to be more than enough for any hot-joggling application.

The time required for heat to penetrate given thicknesses of the extrusions in a hot oil bath of 300 degrees F. was determined by immersing a circular test bar with a Weston dial thermometer inserted in the oil bath. Minimum soaking periods for various thicknesses were determined as follows: Thicknesses up to 0.081 inch, five minutes; thicknesses from 0.082 to 0.125 inch, ten minutes; thicknesses from 0.126 to 0.250 inch, fifteen minutes; and thicknesses from 0.251 to 0.500 inch, twenty minutes.

To determine the effect of the length of soaking at a given temperature on springback after joggling operations, test parts were placed in an oil bath maintained at a temperature of 300 degrees F. and were removed at five-minute intervals up to thirty minutes. These test pieces were joggled immediately after removal from the bath at a pressure of 75 tons. In checking the joggle depths, a variation of only 0.006 inch was found to exist between the six parts tested. It was originally thought that a variation in soaking time caused a variation in springback, but the tests disproved that theory. Therefore, since soaking time is not critical from the standpoint of springback, the joggling pressure should be the same for each production run, as this appears to be the most important factor in maintaining springback within the desired allowance.

Variations in springback result from different cross-sections of extrusions, joggle depths, pres-

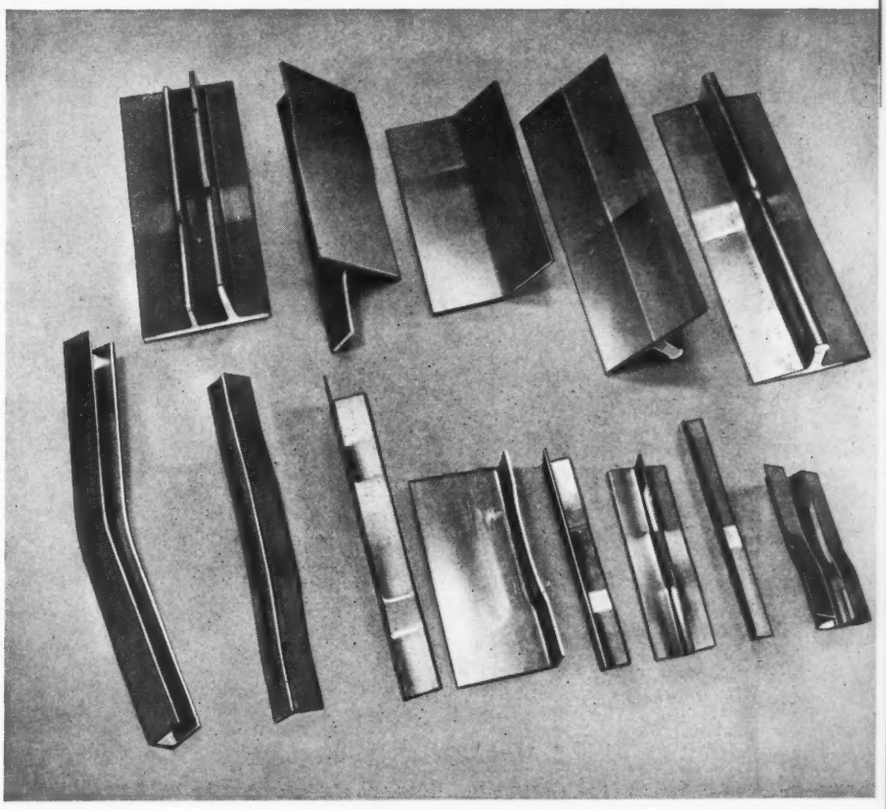


Fig. 1. Examples of typical 75S-T6 aluminum-alloy extrusions that have been joggled after being heated to a temperature of about 300 degrees F.

sures, and locations of the area being joggled with respect to the press ram. As the result of tests, a recommendation was made for a nominal springback allowance of 35 per cent of the required joggle depth for the first tool proving operation. This takes into consideration the fact that the springback on most jobs falls below 35 per cent of the joggle depth and that it is easier to decrease a joggle depth on a tool than to increase it.

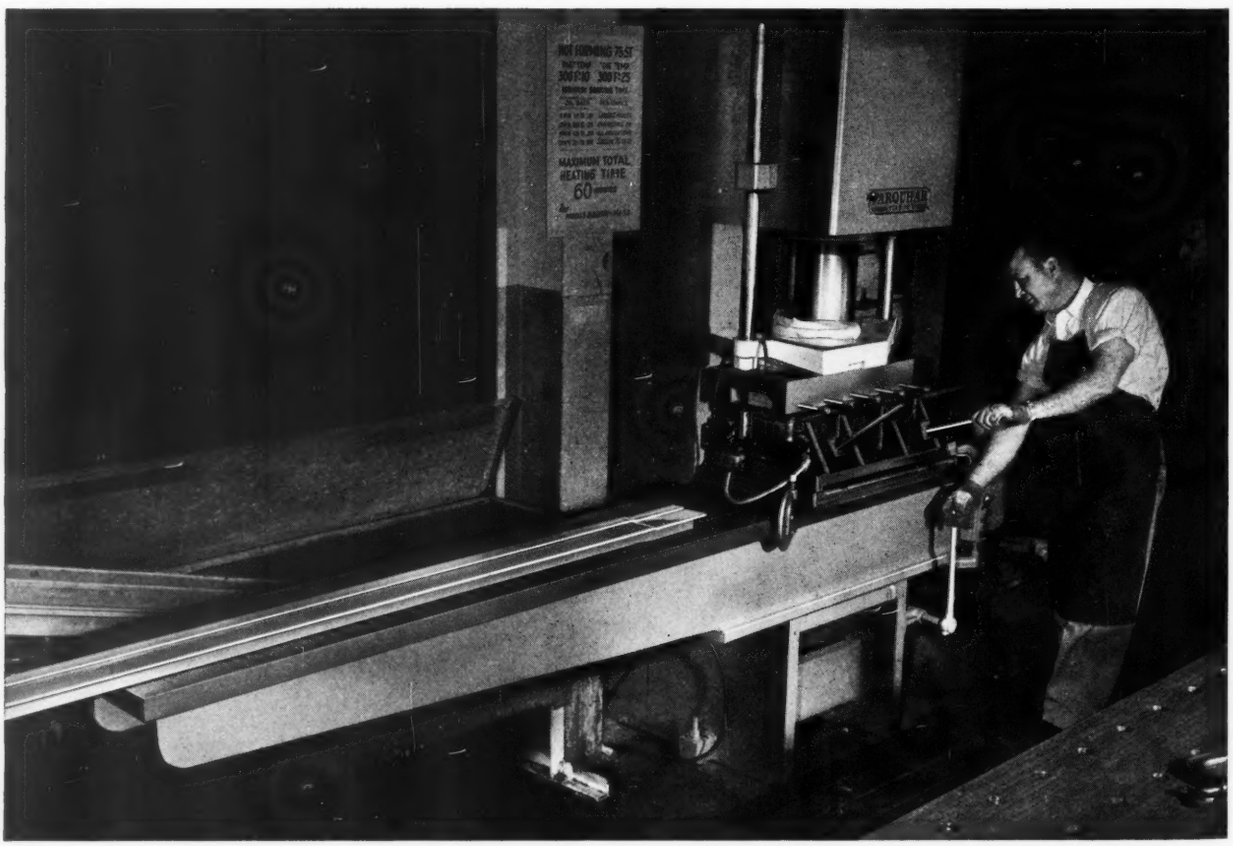
The critical factors in hot-joggling 75S-T6 aluminum parts heated by the hot oil bath method may be stated as follows:

1. The required oil temperature must be used; that is 300 degrees F. within ± 10 degrees F.
2. The specified soaking time must be complied with to insure thorough heating of the parts.
3. The forming tools must be heated to 300 degrees F. within ± 25 degrees F., so that the parts will not be chilled by the cold dies.
4. No time must be lost in transferring parts from the heating medium to the forming tools, so that the temperature of the parts is not below 275 degrees F. at the time of joggling.
5. To prevent over-aging and a loss in mechanical properties below specification requirements, a maximum soaking time of one hour must not be exceeded.
6. The inspection department must check the heated areas with hardness testers for over-aging.

Electrical Resistance Heating of Work for Hot-Forming Operations

Forming and joggling operations on extrusions and rolled sections that have been heated by the electrical resistance method are performed on a Farquhar hydraulic press, a Hufford stretch-forming press, and mechanical punch presses. These machines have been installed adjacent to each other to facilitate their opera-

Fig. 2. Hot-joggling operation being performed on long aluminum extrusions after the extrusions have been heated to a temperature of 300 degrees F. in the oil bath seen at the left of the press



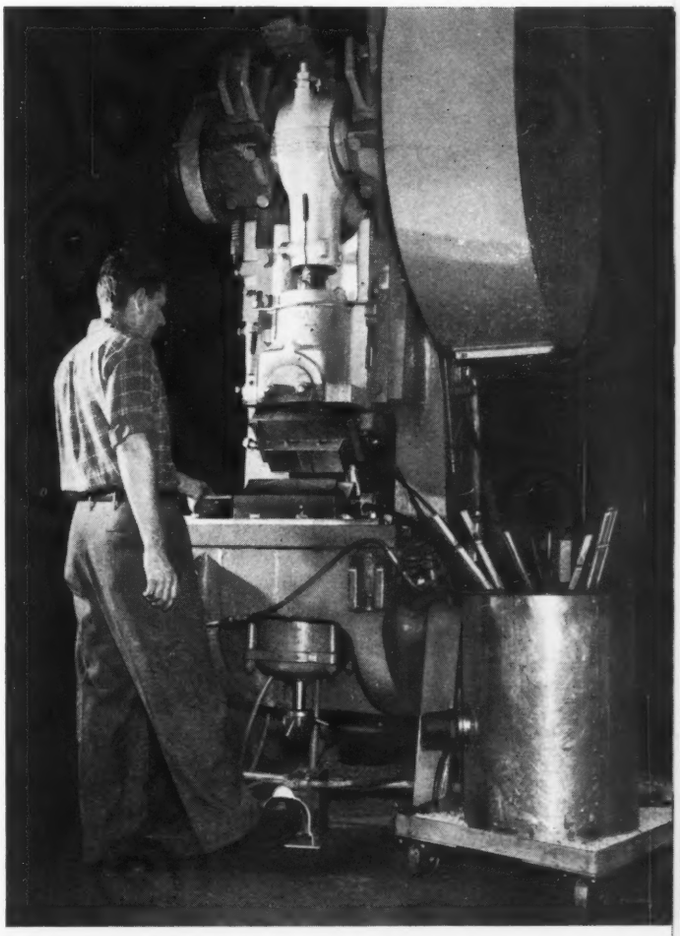


Fig. 3. Hot-joggling operation performed after the short aluminum extrusions have been preheated by immersing in the hot oil tank at right of machine

tion in conjunction with portable heating equipment. The heading illustration shows one of the heating units beside the Farquhar press.

Based upon the results of tests, 30-KVA single-phase alternating-current resistance heating equipment has been selected as the most desirable for production applications. The equipment is provided with six tap settings on the transformer to permit the use of 5 1/2 to 15 volts and with a phase shift control that allows for operation at anywhere from 20 to 100 per cent of capacity.

A 3-inch diameter bus-bar transmits the electrical energy to the contact points. C-clamps are being used at present for clamping work to the contact points, as seen in the heading illustration, but the possibility of using hydraulic clamps is being investigated.

The first test on this electrical resistance heating unit was made to determine if the heating time for parts could be standardized at approximately one minute. Extrusions of various cross-sectional areas and lengths were heated with different tap and heat control settings of the heating unit. The tests showed that for areas less than 0.200 square inch and with the lowest settings of the machine (Tap 1 and Heat Control 20 per cent), a one-minute heating cycle is not satisfactory. However, the number of parts with areas less than 0.200 square inch are limited.

In general, hot joggling and forming in the fabrication department are performed on parts requiring a distance of from 12 to 25 inches between the contact points of the heating unit. These parts can be heated with Tap 1 or 2 settings and with the heat control at any setting from 20 to 100 per cent. Higher tap settings are not recommended because one minute $\pm$ fifteen seconds is specified as the standard heating cycle.

In cases where the heating cycle is greater than one minute, the Micromax unit is usually satisfactory for determining when the correct temperature has been reached, but to insure against overheating, the Tempilaq method of temperature determination should be employed in conjunction with the Micromax unit. A timer can be used to shut off the flow of current after a definite period of time has elapsed. This period of time will vary due to such factors as increased temperature of the contact points as the parts are being heated and variation in the electrical energy.

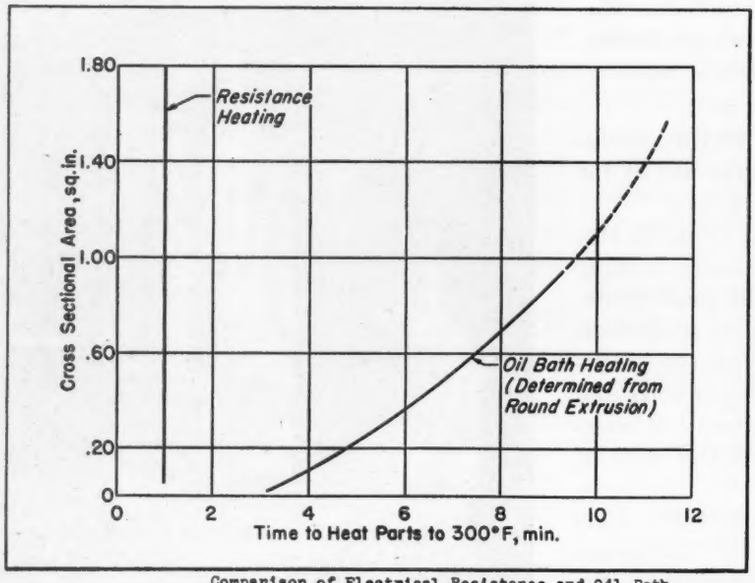
Some of the points that affect uniformity of heating are as follows:

1. The extrusion must be properly located with respect to the magnetic field. Extrusions of various shapes tend to heat rather evenly unless the flange extremities are very thin. By locating the thickest part of the extrusion within the inductive loop having the greatest intensity, an even distribution of heat can be obtained throughout the extrusion. This can readily be determined from experience or by heating a test part.

2. Parts must be of constant cross-section in the heated area in order to be uniformly heated.

3. Oil should be removed from contact areas and they must be cleaned of paint or any foreign particles by polishing with fine emery paper, so as to prevent arcing.

4. A positive connection between the part and the contact points must be made with pressures



Comparison of Electrical Resistance and Oil Bath Heating of 75S-T6 Extrusions to 300°F. (150°C.).

Fig. 4. Comparison of time required for heating 75S-T6 aluminum extrusions to 300 degrees F. by electrical resistance and oil bath methods

of about 1000 pounds per square inch, and the contact must be completely across the contact point in order to prevent arcing.

Comparison of Oil-Immersion and Electrical Resistance Heating Methods

In comparing the two methods of heating 75S-T6 aluminum alloys, one of the main points to consider is the time required to heat the workpieces. With the electrical resistance method, the time required to bring the part to the maximum allowable temperature is a direct function of the cross-sectional area of the part, the area of the inductive loop, the magnitude of the current flow, and the power factor. With the hot oil bath method, on the other hand, the time required to bring the parts to the maximum allowable temperature is a direct function of the thickness of the parts being treated and the temperature of the heating medium.

With adjustable controls on the resistance heating equipment, it is possible to heat any cross-sectional area of material, within the limits of the equipment, to 300 degrees F. in one minute. But with the hot oil bath, the time required to heat work to a temperature of 300 degrees F. increases as the cross-sectional area increases.

One of the main reasons for forming 75S aluminum alloys in the heat-treated and aged condition (T6) is that warpage occurs when material formed in the SO and AQ conditions is heat-treated. Another reason is the large amount of man-hours that can be saved by forming or joggling the heated 75S-T6 alloys. For example, if an order of twenty parts requires one man-hour of time for joggling parts heated by the electrical resistance heating method, four man-hours would be required with the hot oil bath method, but as much as sixty man-hours would be necessary for forming the material in the SO and AQ condition. Typical parts joggled in the heated condition are shown in Fig. 1.

Some New Concepts in Bending

By RALPH M. SHAW, JR., President
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THERE are four basic ways to bend metal. Although many names have been given to present-day methods of bending, they are all basically sub-divisions of the four. Before discussing new advances in the art of bending, it will be helpful to describe briefly these basic processes, which are:

1. *Compression Bending*, which might be compared to the bending of a bar across one knee, while holding one end of the bar.
2. *Draw Bending*, which is similar to the winding of thread on a spool.
3. *Roll Bending*, which is like a small rolling mill.
4. *Ram Bending*, which might be compared to bending a bar between the knees, with one end freely supported on each knee.

Each of these bending methods has its own applications, advantages, and disadvantages.

All bending is done by the creation of a moment, which results from the application of a force at a certain distance from a fulcrum. All four bending methods pertain to structural engineering, and are governed by the same basic flexure formula:

$$F = \frac{M \times Y}{I}$$

where

F = tensile strength at yield point of material to be bent;
M = moment (product of force times distance) created in bending;
Y = distance from neutral axis to outermost fiber of part to be bent; and
I = moment of inertia of section about its neutral axis.

Since $\frac{I}{Y}$ equals the section modulus S for bending,

$$F = \frac{M}{S}$$

It should be noted that, in structural engineering, where failure must be avoided, values on the stress-strain curve below the elastic limit must be employed, whereas in bending, values on the same curve above the elastic limit have to be considered.

In compression bending, which is classified as a "rotary-head" process, the stock is placed against a fixed die and a bending arm "wipes" the part into the die. The process is applicable to the bending of pipe and tube where the wall thickness is appreciable and the radius of bend is about three times the stock diameter, and to bending bar stock and shapes. With this bending method, the neutral axis lies in the outer third of the section, and about one-third of the section is in tension, while two-thirds is in compression. In bending pipe and tube, the flattening effect is about one-half that encountered in draw bending.

In draw bending — another "rotary-head" process—the neutral axis lies on the inner third

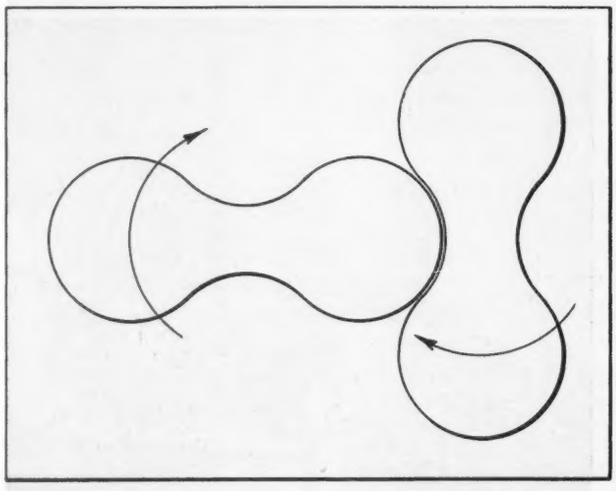
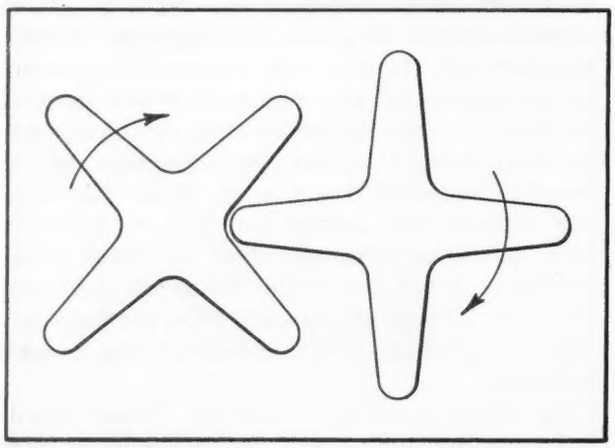


Fig. 1. Flat sheets fed between continuously rotating rollers of the type shown are ejected in the desired corrugated shape

of the section to be bent. Two-thirds of the section is, therefore, in tension while one-third is in compression. The part to be bent is clamped to a rotating die and drawn over either a mandrel or a stop-roll. This process is used to bend thin-wall pipe or tube, or where small radii are necessary. Since the flattening effect is approximately double that resulting from compression bending, a draw bending machine is rarely employed without an internal mandrel.

Fig. 2. By modifying the rolls so that they resemble gears, corrugated or zig-zag shapes can be formed



For roll bending, the piece is laid between three rolls and deflected by the center roll. All three rolls are then driven and the part is rolled to the desired shape. This process is generally employed for bending structural shapes, circles, and helical coils, and is also applied to pipe and tube where the section must be held free from flattening. Bends made in this way are more perfect than those obtained with other methods, but the process is slow. However, if multiple rollers are provided, the machine becomes a production unit and rolls out work at high speeds.

Ram bending is the simplest of the four processes. With this method, the piece to be bent is placed against two rigid supports and force is applied in the center. This action is provided by a punch press or rail bending machine. High production rates can be obtained, but with high-speed punch press operation, the cost of equipment is high. A small, low-cost, hydraulic hand bender can be used for the process, but the production obtained in this way is, of course, low.

Avoiding Wrinkling During Bending

In any bending machine, wrinkes will appear on the compression surface of the piece being bent when a certain radius is reached on material of a specified thickness and hardness. For many years, it was believed that wrinkling was a function of the machine, but it is really dependent on the work-piece, the action being governed by the column formula. When a tube, shape, or bar is being bent in compression, the section from the neutral axis to its innermost fiber acts like a column. The straight-line column formula is:

$$F = \frac{M}{S} - \frac{K \times L}{R}$$

where

K = a constant varying with the material;
L = "length of column" or distance from point of bending to point where force is applied; and
R = least radius of gyration of section in compression.

When $\frac{K \times L}{R} = \frac{M}{S}$, F becomes zero and wrinkling occurs.

To overcome wrinkling, the force can be applied closer to the point of bending, the mate-

rial can be changed, or the cross-section of the part can be increased. More wrinkling is encountered with compression bending than with draw bending. By using an internal mandrel, wrinkles can generally be ironed out as fast as they are formed.

How to Overcome Springback

Springback is a function of the elasticity of the material being bent, and it can be overcome by five processes: (1) By heating (stress relieving; (2) by tension (stretch bending); (3) by impact (hammering after bending); (4) by compression; and (5) by electricity.

When force is applied in a direction normal to the direction of the strain in a part, the stresses are relieved and the strains eliminated. This principle is employed in one type of stretch bending machine in which the ends of the bent piece are held in hydraulic jaws and the part is stretched to remove the stresses set up during bending. Springback is thus avoided.

The same effect can be obtained by compression. If the part can be compressed beyond its elastic limit, with the force applied normal to the direction of inherent strain in the part, the strain can be removed. This was proved by the following test, in which the inherent stresses in cold-rolled steel were removed during bending.

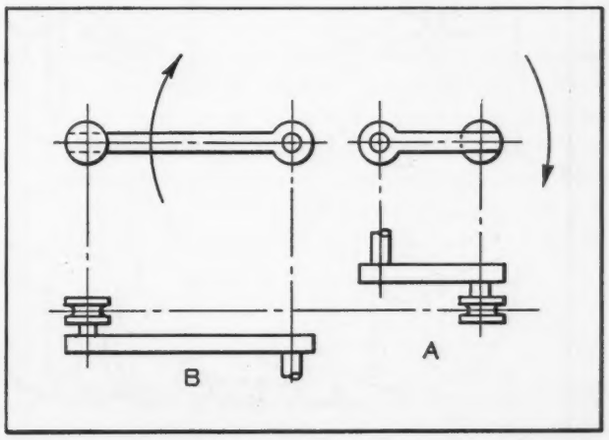
After machining one side of a straight length of cold-rolled steel bar stock, the bar became bowed, showing that stresses existed in the bar as a result of the cold-rolling process. An unmachined bar was then bent into a U-shape, the legs of the part were sawed off, and the distance across the inside of the U was measured. This part was then chucked in a lathe and a cut taken on its periphery. After cutting, the distance across the inside of the U was again measured and found to be unchanged. This indicated that the inherent stresses set up during rolling had been relieved.

Another phenomenon observed was that the stresses set up during bending were also apparently relieved. Another bar was bent into a U-shape, but its legs, with were about 12 inches long, were not removed. After measuring the distance across the inside of the U at the ends of the legs, a cut was made half way through the outer surface at the bottom of the bend. If the inner surface had been under compressive stresses and the outer surface under tension, the sawing should have caused the ends of the legs to spring apart. However, there was no appreciable change in the measured distance, which indicated that the compressive stresses in the part had been relieved. Another similarly bent part was sawed half way through the inner surface of the bend. Again there was no change in the measured distance, which indicated that the tension stresses had also been relieved.

When subjected to a pressure of about 250,000 pounds per square inch, steel and other metals apparently change from a crystalline structure to a solid, non-crystalline solution. While in this eutectoidal condition, the part is malleable and has no elasticity. Thus it can be formed into any desired shape. These principles are employed in the new "cold-welding" process, wherein fusion is made simply by pressure, without the application of external heat. Upon removing the pressure, the piece recrystallizes without stresses being set up. Recrystallization is not immediate, the time varying from about ten seconds to several minutes for various materials. Little is known at the present time about the physical properties of materials when they are subjected to such terrific pressures.

Another method of stress relieving, about which little is known, is the electrical method. When a formed piece having inherent stresses is subjected to an intense electromagnetic field, the part is apparently stress relieved.

Fig. 3. Bender for forming box-shaped coils. Length of coil equals distance between dies on arms (A) and (B), and width, twice the length of arm (A)



New Adaptations of Existing Bending Processes

Contributions to the mechanical art of bending have been few in number during the last few years. No new processes have been developed, but there have been several adaptations of existing processes. One interesting adaptation consists of an automatic machine for rolling profiles. In this machine, a three-roll pyramid is employed, the position of the central roll being controlled by a cam.

For example, to bend the cross-frames for trolley-car roofs, the cross-section of which has a double parabolic shape, flat sheets are fed between the rolls. The cam directs the roll into position for forming the sharply curved vertex section of the parabola. The roll gradually retraces its path to form the broad sweep of the desired shape, then reverses its motion until the other vertex is formed, and finally is automatically lifted away as the part is completed.

All the operator needs to do is to start the machine and feed the stock. No dies are required, but a cam is necessary for each different shape. Such cams can be flame-cut from steel plates, or even sawed from plastic sheets or hard wood.

The method of rolling corrugated sheets is an older adaptation of a bending process, but its principle has been applied for other purposes. Basically, this simple method makes use of a pair of rolls, Fig. 1, which rotate continuously. Flat sheets are fed between the rolls at one end and are ejected in the desired corrugated form from the opposite end. If these rolls are recut so that they more nearly resemble a gear, Fig. 2 (where the height of the "teeth" is large in relation to their width and there are not more than four or five teeth on each roll), it is possible to roll strip, sheet, or bar stock into corrugated or zig-zag shapes with a distinct tangent between bends. Machines equipped with such rolls are used to form the supporting trusses for the Davis type bridge.

It is sometimes necessary to make all the bends in a part in the same direction, as, for example, in forming box-shaped coils. Parts of this kind

(Concluded on page 165)

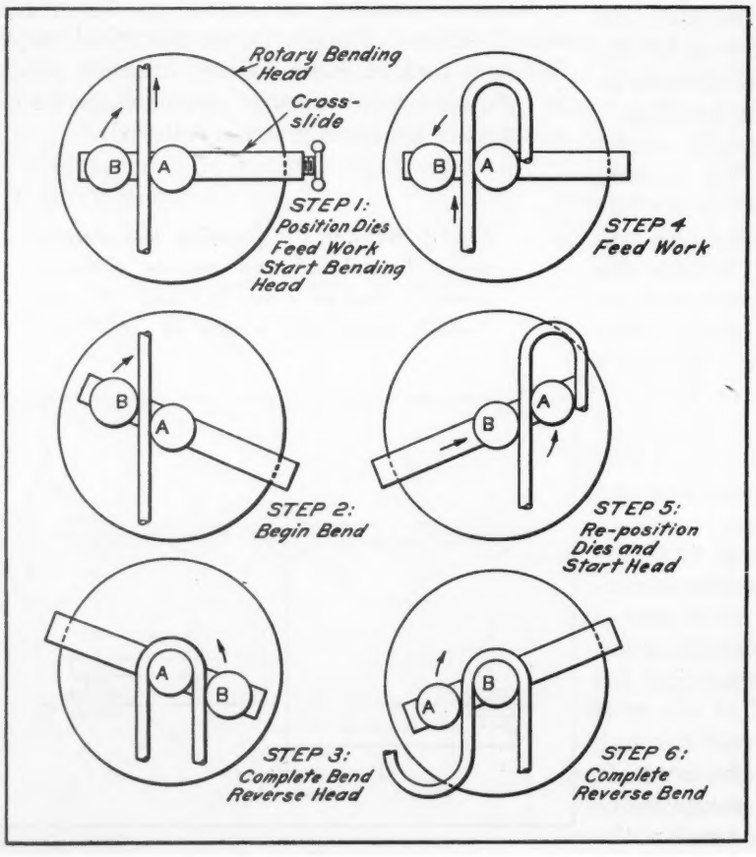

Rotary Bending Head
Cross-slide
B
A
STEP 1: Position Dies Feed Work Start Bending Head
STEP 4 Feed Work
STEP 2: Begin Bend
STEP 5: Re-position Dies and Start Head
STEP 3: Complete Bend Reverse Head
STEP 6: Complete Reverse Bend

Fig. 4. Successive steps employed to form serpentine coils on a double-head type bending machine. The direction of the head is reversed for producing the second bend. This device can be used for either draw or compression bending

Do Machines Throw Men Out of Work?

EVER since the Industrial Revolution in England over two hundred years ago, loose thinking men in labor circles have asserted that mechanization of industry throws men out of work. This erroneous idea has been challenged effectively from time to time by economists who have given long study to the relationship between employment and the increased use of high-production equipment.

No more effective reply has been made than that presented in a booklet recently published by the Michigan Tool Co. This booklet shows that, in every single year since 1910, employment of production workers went up when the rate of mechanization increased, and, conversely, employment declined in every year that the rate of mechanization was reduced. Whenever mechanization was increased sharply, employment went up sharply, and vice versa.

The authenticity of these facts is unquestionable because the employment data was obtained from the United States Department of Labor and the mechanization statistics from the United States Department of Commerce. There are instances when the rate of mechanization increased steadily for periods of as long as four successive years. If there were any rhyme or reason for statements that the increased use of high-production machinery decreases employment, that condition would become apparent during such a long period, but the reverse is true —employment increased steadily. And in a following year when the rate of mechanization went down, it was accompanied by reduced employment.

Despite such incontrovertible facts, Philip Murray, president of the C.I.O., recently claimed: "The machine is displacing the man . . . Organized labor is not going to sit idly by and permit the widespread introduction of machinery to starve its men and women to death." His philosophy is two hundred years behind the times. The real facts were stated by David Ayr, president of the National Machine Tool Builders' Association, when he said: "Good machines mean more employment, not less . . . By cutting costs, volume of manufacture goes up, more people are employed."

As the Michigan Tool Co.'s booklet points out, the surest way to increase productive employment is to maintain a high rate of installation of so-called "labor-saving" equipment. The surest way to throw men out of work is to stop mechanizing industry.

With the huge defense program ahead of us, unemployment is not likely to be a problem for a long time to come, and so the age-old argument about machines and men may not be very important now. But it will be revived again some day, and it is well to be prepared with indisputable facts.

Charles O. Herb

EDITOR

Design of Worm-Gear Hobs

First in a Series of Articles Describing Methods of Designing Various Types of Worm-Gear Hobs, Based on British Practice

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IN this article, the conditions essential to the proper generation of worm-gears are discussed and the design aspects of fly hobs outlined. In subsequent articles, design proportions of various types of hobs, hob modifications, and design schedules will be discussed.

Before any intelligent consideration can be given to the design of a hob for cutting a worm-gear, it is essential that the fundamental differences between worm-gears, on the one hand, and spur and helical gears, on the other hand, be properly understood. These differences are due to the curved face of the worm-gear, and the resultant tooth form. As a consequence of the curved worm-gear face, it can be seen that the surfaces swept out by the cutting edges of the hob must be identical with the flank surfaces of the worm. This can only be the case when there is a special hob to cut the worm-gear with which each worm is to mate.

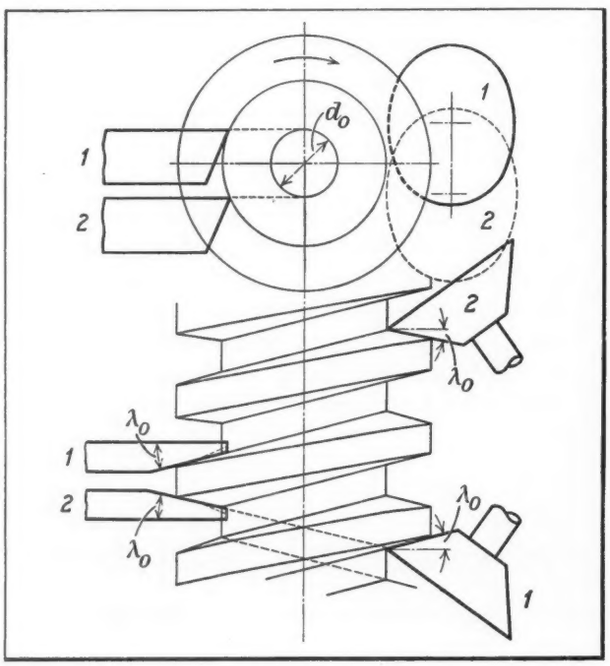


Fig. 1. Tool settings for generating a hob of involute helicoid form

A considerable degree of standardization is, therefore, essential if the number of hobs is to be kept within reasonable limits. This is in direct contrast to the use of a hob for cutting spur and helical gears, where the same hob can be used for gears of a given pitch and pressure angle, irrespective of the number of teeth in the gear and the pinion or of the helix angle.

Owing to this characteristic of worm-gears, a considerable number of such gears are cut by fly hobs, since these are cheaper and simpler to produce than full hobs, and are useful, therefore, when the worms are non-standard. It should be noted, however, that the cutting rate of a fly hob is very much lower than that of a full hob.

The hobbing of worm-gear teeth may be regarded as an example of copy generation. The conditions necessary for the proper generation of a worm-gear are:

(a) The cutting edges of the hob must lie in the same surfaces as the flanks of the worm thread would occupy.

(b) The cutting edges of the hob, during the whole of their cutting action, must trace out the same surfaces as those occupied by the flanks of the worm thread when that thread is in mesh with the worm-gear.

(c) The rotational rates of the hob and of the worm-gear must be in the correct ratio.

The simplest case occurs when the generating hob has a large number of flutes and a small number of threads. Under these circumstances, condition *(b)* may be waived, and a satisfactory worm-gear can be generated by rotating the hob and the gear at the correct speed ratio, while feeding the hob radially to full depth in the worm-gear. Such a process produces a gear-tooth flank with a surface consisting of a series of small flats. Owing to the large number of cutting edges on the hob, these flats are very

small indeed, and the surface approximates closely to the theoretical. It is often suggested that such a cutting process results in the removal of certain useful parts of the gear-tooth flank, but this is only true when the gear teeth are of an under-cut form. Since such a tooth form is undesirable in any event, this objection is of little consequence.

With the normal design of hob, however, all three conditions must be satisfied. This can be achieved by giving the hob a slow feed along its own axis, the hob having been set previously so that its pitch cylinder is tangential to the pitch circle of the gear at the throat, but so that the hob teeth are not touching the work. With this tangential feed method, the profile error due to the surface facets is reduced considerably. It should be noted that the most accurate results are obtained when the hob feed is opposite in direction to the motion of the gear teeth. If the hob feed and the gear motion are in the same direction, the gear tends to float between the backlash limits of the dividing gears. For the same reason, it is inadvisable to attempt to cut the two flanks of the worm-gear teeth separately, as one may be tempted to do when the hob is under size as a result of sharpening.

Similarly, it is usual to mount the worm-gear with its axis vertical in the hobbing machine, and to arrange the hob so that its cutting edges move downward while cutting the gear teeth. With this arrangement, all thrusts are downward, and there is no tendency for the worm-gear to float vertically.

When the hob is fed radially into the worm-gear, the relation between the rotational speeds of the hob and of the worm-gear is given by the equation:

$$N_h = N_w \times \frac{T}{t}$$

where

N_h = R.P.M. of hob;
N_w = R.P.M. of worm-gear;
T = number of teeth in worm-gear; and
t = number of threads in hob.

If, however, the hob is fed tangentially in a direction opposite to that of the gear-tooth movement, the hob must be given one extra revolution while advancing a distance equal to its lead. Thus, if the hob makes $(x+1)$ revolutions while advancing a distance equal to its lead, then during the same period the gear should make $xt \div T$ revolutions. Usually, this extra revolution of the hob is provided by a differential in the hob traversing motion.

The thread of the worm, and thus of the hob, may be any of several different forms. It is probable that, of these, the two most popular are the worm thread of involute helicoid form and the worm thread that is straight-sided in an axial section. The difference between these two thread forms in the case of a single-start worm is very small, but becomes appreciable with a multi-start worm. Equations may be developed by the aid of which the difference may be determined. These show that if the two threads have the same axial thickness at the pitch cylinder, the straight-sided thread is slightly thicker at the crest and root than the involute helicoid thread. The axial pressure angle at the pitch cylinder is identical, however.

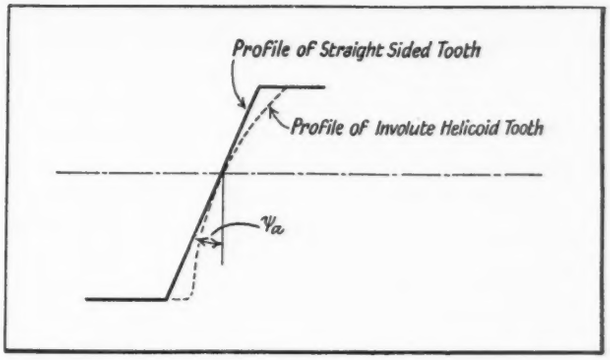


Fig. 2. Worm thread profiles in axial section

If the thread of the worm is of true involute helicoid form, it is straight-sided in an offset section, and

$$d_o = d \times \cos\left\{\tan^{-1}\left(\frac{\tan \psi_n}{\sin \lambda_t}\right)\right\} \qquad (1)$$

Also,

$$\text{Tan } \lambda_o = \frac{L}{\pi d_o}$$

or

$$\lambda_o = \tan^{-1}\left(\frac{L}{\pi d_o}\right) \qquad (2)$$

where

d = pitch diameter of hob or worm;
d_o = base diameter of hob or worm;
ψ_n = pressure angle, in normal plane, of the basic rack;
λ_t = lead angle of thread at pitch radius;

$$\lambda_t = \tan^{-1}\left(\frac{L}{\pi d}\right) \qquad (3)$$

L = lead of thread of hob or worm;
λ_o = lead angle of thread at base-circle radius; and
λ_o = generating tool angle.

To generate such a thread, the generating tools

must be set so that their cutting edges are tangential to the base cylinder of the hob or worm, as shown in Fig. 1.

If, however, the thread form is straight-sided in an axial section, the flank angle of the thread in this axial section is ψ_a where

$$\psi_a = \tan^{-1}\left(\frac{\tan \psi_n}{\cos \lambda_t}\right) \qquad (4)$$

A thread of this form can be generated by a straight-sided tool, set in an axial plane of the hob.

Fig. 2 shows the two thread forms in an axial section of a worm. The difference between the forms has been exaggerated for the sake of clarity.

There are two other thread forms that are commonly used. The first of these is a thread that is straight-sided in a section normal to the worm thread. Such a thread is produced if the worm is cut in a lathe by a straight-sided tool, set so that the top face of the tool is normal to the thread helix at the pitch radius. This thread is slightly more concave in form than a thread that is straight-sided in an axial section, and its use is not recommended, since it is prone to under-cutting.

The other thread form meriting particular note is produced by a beveled milling cutter or grinding wheel having its axis set normal to the thread helix at the pitch radius. The edges of the cutter are straight-sided in a radial section. This produces a thread the precise form of which is very difficult to determine, being dependent on the diameter of the cutter. It usually lies between that of the axial straight-sided thread and that of the involute helicoid. If the cutter were of infinite diameter, the thread form would be an involute helicoid.

A fly hob normally has only one pair of cutting edges, but some fly hobs are made with a pair of cutting edges for each thread of the worm that is to mate with the worm-gear to be cut. As has been stated earlier, fly hobs are simpler and

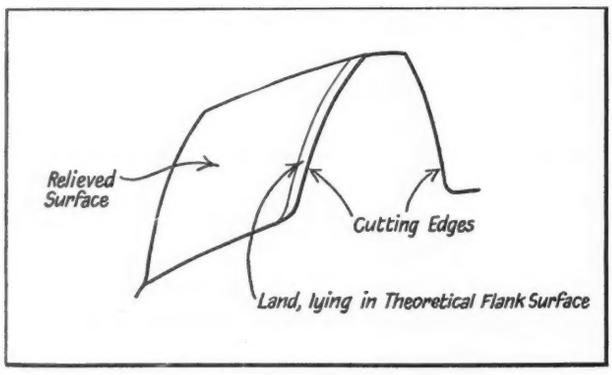


Fig. 4. Diagram showing relief of cutting profile of fly-cutter tooth

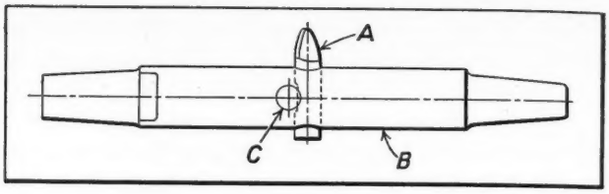


Fig. 3. Simple type of fly hob for worm-gears

cheaper to produce than full hobs, and are used when the number of worm-gears to be cut is insufficient to justify the trouble and expense of making a full hob. In addition, fly hobs may be used when there is insufficient time available to permit the production of a full hob.

A fly hob having a single pair of cutting edges is shown in Fig. 3. The cutter tooth *A* is made of high-speed steel, and secured in the arbor *B* by means of the cotter-pin *C*. The arbor should be as stiff as possible to resist bending under cutting loads. Before assembly in the arbor, the cutter tooth *A* is rough-ground by hand to the approximate shape, and is given a negative hook of about 10 degrees, so as to reduce risk of breakage.

After the tooth has been secured in the arbor, the outside of the cutter is ground to the correct radius. The two sides of the tooth are then ground so that they have the same pressure angle and lead as the worm, but the thread thickness is left greater than that of the worm by an amount equal to the backlash allowance, at the appropriate radius. This operation is carried out on a worm grinding machine.

It may be necessary to have a test piece of deeper section than the actual cutter tooth, held in an arbor similar to the hob arbor, to insure that sufficient ground flank surface is available for checking the pressure angle. This applies particularly to fly hobs of the involute helicoid type, where the profile is straight-sided in an offset section. The grinding head is adjusted until the pressure angle of the test piece is correct, after which the hob tooth flank is ground at the same setting. The hob tooth may be regarded, therefore, at this stage in its manufacture, as an unrelieved section of the worm thread.

For the hob tooth to have a satisfactory cutting action, the cutting edges must be relieved. This relief is obtained by altering the lead of the grinding machine and the inclination of the grinding wheel. The lead must be lengthened to relieve the leading edge, and shortened to relieve the trailing edge. If

L = lead of worm thread;
L_l = lead of relieved leading edge;
L_t = lead of relieved trailing edge;
β = relief angle (usually 3 degrees);

λ_t = lead angle of hob at pitch diameter; and
d = pitch diameter of hob
then

$$L_1 = \pi d \tan (\lambda_t + \beta) \quad (5)$$

$$L_t = \pi d \tan (\lambda_t - \beta) \quad (6)$$

The grinding wheel axis must be adjusted until a uniform land is left on the cutting edge, as shown in Fig. 4. The amount of adjustment will be approximately equal to β, but the actual value will depend on the hook angle. The flank must then be ground carefully until the land has been reduced to a width of approximately 0.010 inch, this being finally stoned away.

A quicker method of relieving the flanks is to grind them by hand on a carefully dressed wheel until a narrow uniform land is left on the cutting edges, finally stoning until this disappears. After a little practice, fly hobs can be relieved very satisfactorily in this manner in a minimum of time.

It is necessary, in addition, to relieve the top of the tooth. This is usually done by hand grinding in such a manner that the width of the top of the tooth is approximately constant along its length.

It may be gathered from the description of the production method given that a fly hob is far from being a precision tool, but the cutting profile should be reasonably accurate in form. It must be noted, however, that any sharpening of the fly hob completely destroys that form. Thus, when a fly hob requires to be sharpened, the bit must be moved outward slightly and the flanks reground. This insures that the backlash will remain constant and the form correct. The bit must not be readjusted after regrinding.

Fig. 5 shows a large fly hob having three pairs of cutting edges, designed to generate a worm-gear that is to mesh with a triple-start worm. This type of hob is made in the same manner as the single-toothed fly hob, and is used when the worm is large, since, in these circumstances, the extra time involved in making the hob is more than offset by the time saved during the cutting of the worm-gear. The arbor for such a fly hob is hollow, so that the three cutter blades can be fitted more easily.

A fly hob with more than one blade can be used to advantage for cutting worm-gears for use with smaller worms when the worm and gear have an even ratio; that is, when the number of teeth in the gear is exactly divisible by the number of threads in the worm.

Thus, if a single-bladed fly hob is used to cut a worm-gear having T teeth, which is to mesh with a worm having t threads, then $T \div t$ tooth spaces will be cut for each traverse of the hob through the zone of contact. Thus the hob must be traversed t times to cut all the teeth. In the general case, where T is not exactly divisible by t, the hob must be traversed n times, where n is the highest common factor of T and t.

If a hunting tooth is employed, so that T and t have no common factor, no indexing is necessary whatever type of hob is used, so that the cutting time using a single-bladed fly hob is reduced considerably. For this reason, a hunting tooth is usually recommended, as accurate indexing is very difficult. In addition, it should be noted that even when a full hob is used for cutting a worm-gear, the operation is more accurate if there is a hunting tooth in the gear than if there is no such tooth. With a hunting tooth, each thread of the hob cuts each tooth space of the worm-gear, so that any spacing errors in the hob are balanced out. Spacing errors on the hob cutting faces are very difficult to avoid.

Against this, a gear without a hunting tooth should have a longer life, as, in these circumstances, each tooth on the gear meshes with only one thread on the worm, and thus beds itself down to suit that particular thread. If a hunting tooth is employed, each tooth of the gear meshes with each worm thread, and thus endeavors to run itself in to suit each worm thread. As the worm threads can never be exactly the same, and are not altered appreciably during running (since the wear takes place on the gear), it appears that the wear rate with a hunting tooth will be greater than the rate without a hunting tooth, especially if the worm has not been made to a particularly high degree of accuracy.

As far as is known, no tests have been carried out to check this theory, but it is certain that worm accuracy is of prime importance, especially when a hunting tooth is used.

The main disadvantage experienced in using a fly hob, compared with a full hob, apart from the extra time taken in generation, is that the cut-

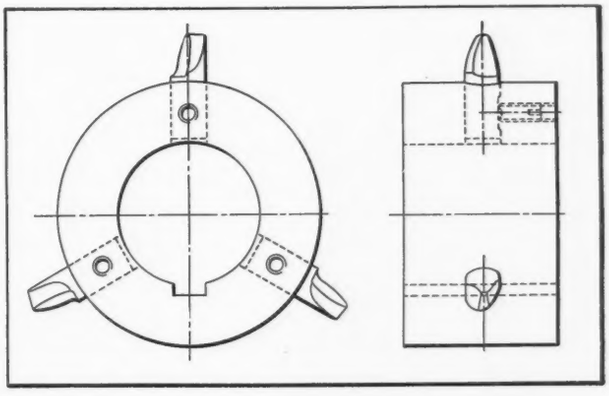


Fig. 5. Fly cutter with three teeth for generating a worm-gear to mate with a three-start worm

ting edges soon lose their sharpness, due to the amount of work they have to do. As a result, the worm-gear is likely to suffer in accuracy.

If a particularly accurate worm-gear is required and a full hob is not available, it is advisable to make two fly hobs, one for roughing and one for finishing. The two hobs are ground at the same setting, but the tooth on the roughing hob is made thinner than that on the finishing hob by about 0.020 inch. Alternatively, if a hob of similar, but not identical, proportions is available, this may be used to rough out the teeth on the worm-gear, the work being completed with a fly hob.

There are two methods of cutting a worm-gear with a fly hob:

1. The hob is set centrally and fed radially. When at almost full depth, the hob is given a tangential feed across the gear.

2. The hob is offset axially from the central position and is fed tangentially across the gear two or more times at increasing depth until the correct center distance has been reached.

It should be noted that, however slow the tangential feed of a fly hob may be, its progressive displacement between cuts on the same tooth results in the flank surfaces being composed of a number of flats. A full hob, with a tangential feed, reduces the size of these flats until they are imperceptible.

In the next article of this series, design proportions for full hobs will be developed.

Guideposts to Industrial Operations in the Present Crisis—Theme of N.M.T.A.

THE fifty-first annual convention of the National Metal Trades Association was held at the Hotel Commodore, New York City, September 27 to 29, inclusive. An outstanding program was presented, designed to help meet the needs of management under the present critical conditions of the nation. Major General Lewis B. Hershey, Director of Selective Service, spoke on "Selective Service in the Present Crisis"; James P. Selvage of Selvage & Lee, New York City and Washington, took as his topic "Business Goes to Washington"; and David R. Clarke, general counsel of the Association, presented cogent facts about the Defense Production Act of 1950.

Talks were also given on work simplification; guarding against sabotage in industry; training programs for emergency production; the responsibility of management in developing good human relationships; and the impact of Social Security legislation on industrial pensions. Panels were held on industrial relations and employe communications.

Harold S. Falk, president of the Falk Corporation, Milwaukee, Wis., was presented the annual award of the Association "for outstanding achievement in the field of industrial relations which has significantly furthered the principles for which the Association stands."

Elected president for the coming year was J. L. Kopf, president, Jabez Burns & Sons, Inc.

Thomas J. Morton, Jr., retiring president of the National Metal Trades Association (at left) presenting the annual award of the Association to Harold S. Falk, president of the Falk Corporation

Precision Form-Grinding of Punches and Dies

The High Degree of Accuracy Required in Precision Punches and Dies of Irregular Shape Often Makes Them Expensive to Build and Maintain. A New Method of Making Such Tools Quickly with Exactly Matching Forms so that Their Components Can be Interchanged is Described in This Article

By GEORGE H. DeGROAT

PRECISION punches and dies of irregular shape require perfectly matching forms and well supported punches to insure the success of their operation. The more intricate and unsymmetrical the form, the more essential is the requirement for a perfect fit between the punch and die and for rigid punch support.

These conditions are met in a new diemaking process that provides a means of form-grinding the components of such tools so that each mating part precisely matches the other. The equipment employed consists of a surface grinder known as the "Dupliform," with an integral wheel-dresser, recently developed by Airborne Accessories Corporation, Hillside, N. J. A templet or sample part is used initially for dressing the grinding wheel to the form required in the die or the punch, whichever is to be made first, after which the resulting form-ground tool can be employed as a templet to dress the wheel for grinding the remaining parts. In this way, each part is made from another, with the result that all are perfectly matched.

The wheel-dresser is mounted on the main column of the grinder as an integral part. It will be seen from the heading illustration that the dresser can be swung out of the way of the grinder table when it is not in use and can be returned to its exact original position when the grinding wheel requires redressing. The dresser is so constructed that a 1:1 ratio exists between the movement of the tracer and the diamond, thereby permitting the forming of the grinding wheel directly from a sample part or templet without an enlarged master.

The tracer, which is guided by hand over the contour of the templet or other formed piece to move the diamond in a similar path across the face of the wheel, is easily corrected so that its nose will conform with the shape of the diamond point. As is well known, when working to very close tolerances, serious errors in form can occur with tools of this type if the diamond point wears while the tracer nose retains its original shape. This condition is eliminated with the "Dupliform" method of form-grinding.

To illustrate the advantages of this method, a step-by-step procedure employed in making a typical die of irregular shape to close tolerances will be described.

Fig. 1 shows the shape of the opening in this two-stage piercing and blanking follow-die, together with the dimensions and the extremely close tolerances to which it is made. It will be noted that the die is split to form two sections, one being of convex form and the other concave in shape. Fig. 2 illustrates the components of this die in more detail.

In the first operation, a bar of high-carbon high-chromium tool steel, 3/4 inch thick by 1 1/2 inches wide by 14 inches long, was rough-machined to remove the scale, and then carefully

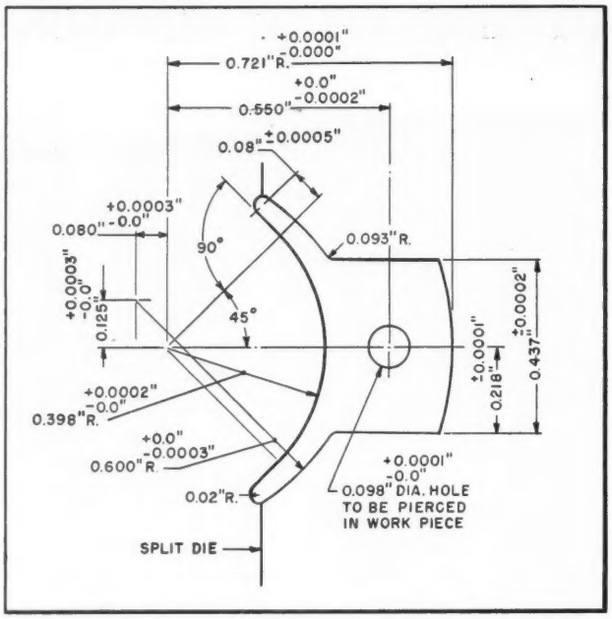


Fig. 1. Dimensions and tolerances of an irregular-shaped split die for producing pole shoe laminations

ground square and parallel while soft. By maintaining the squareness of the components of the tools from the very beginning of this procedure, all the subsequent operations can be performed faster and more accurately.

The bar is then cut into four pieces, each approximately 3 1/2 inches long. Two of these pieces will ultimately become die sections, and the other two, made of the same material and to the same dimensions, will be used for holding the blanking punch. A bar of Brown & Sharpe oil-hardening flat stock, 3/8 inch thick by 1 1/2 inches wide by approximately 7 inches long, is also rough-machined and ground square and parallel as the first step in making the two halves of a stripper plate. This bar is cut into two pieces, each about 3 1/2 inches long. One end of each of these six pieces of tool stock is then ground square, after which all six pieces are set up together on the ground ends and the opposite ends are ground to obtain uniform lengths.

After all sharp edges have been broken with a file, the six pieces comprising the die components at this stage are ready for bench operations. In this work, the shape of the die and the screw- and dowel-holes are carefully laid out in two of the high-carbon high-chromium pieces. The screw- and dowel-holes are then drilled in all six pieces by clamping the parts together and aligning them.

Using some of the holes thus produced, the parts are joined with bolts and nuts to form two assemblies, each consisting of two of the high-carbon high-chromium pieces and one of the oil-hardening steel pieces. In making these assemblies, the flat surfaces of adjacent pieces are kept clean and free from burrs in order to insure squareness.

After stamping identification numbers on each piece, the concave shape is rough-machined in one assembly by milling and the convex form produced in the other assembly in a similar manner. In other die work, the form might be rough-ground into the blocks, depending upon the complexity of the shape and the amount of stock that is required to be removed.

Fig. 2. Inspecting completed components of the die illustrated in Fig. 1. The blanking punch with pilot may be seen in the foreground

One of the concave pieces is then drilled to hold the piercing punch, and this piece is used as a guide in drilling corresponding holes in the other two pieces of this shape. Although the hole to be pierced in the work-piece is only 0.098 inch in diameter, a 5/16-inch hole is reamed through the three concave pieces.

The punch-holder will accommodate a punch with a shank 5/16 inch in diameter; the stripper and die piece are provided with bushings of this diameter having 0.098 inch diameter bores. In this way, a sturdy punch, necked down to the proper diameter can be employed rather than a long slender one. Moreover, since all three pieces are identical, interchangeability is facilitated, as will be seen later. In the convex assembly, only the stripper block is drilled, the hole being required for an automatic spring stop.

The blanking punch is produced in a manner similar to that used for making the die and the stripper blocks; that is, a block of high-carbon high-chromium steel is cut, ground square and parallel, and then a hole for a 0.098-inch diameter pilot-pin is drilled and reamed through its entire length. This is followed by rough-grinding the block square and parallel relative to the 0.098-inch hole by using a dowel-pin in each end of the hole for locating purposes. Approximately 0.015 to 0.020 inch stock is left all over for form-grinding. After rough-grinding, the block is hardened.

All the die sections are hardened to 62-64 Rockwell C, and the stripper pieces are hardened to 59-61 Rockwell C, after which all sharp edges and burrs are stoned off. The stoning operation is performed to insure that all the pieces will lie flat on the grinder chuck, so that they can be ground parallel and to the same thickness on two sides adjacent to the form.

After lapping the dowel-holes to remove scale, the sections are doweled and bolted together again to form two assemblies, as previously described. One of the two assemblies is then clamped to an angle-plate on the chuck and the side opposite the form is ground square with the previously ground surfaces. The newly ground surface then becomes the reference side for all further grinding.

This process is repeated with the side opposite the form clamped to the angle-plate and an adjacent side is ground flat, after which the work is turned around and the side opposite that one is ground. In all of these surface grinding operations, the amount of stock removed is such that the form remains centered, this being the purpose of the whole procedure. Again, all sharp edges and corners are stoned to remove burrs.

At this stage, the work is ready for form-grinding. The first step is to select a wheel that has free cutting characteristics and that holds the form in operation. The wheel should also be of such a material as to subject the diamond to minimum wear. For form-grinding of this type, where the material is high-carbon high-chromium tool steel, a vitrified bond, aluminum-oxide wheel of 60 grain, J hardness, and 5 structure is used.

The next step is to dress the wheel to rough-grind one of the assemblies. Taking the convex section first, a sample of the work, made to a reasonable thickness, is used for a templet, as shown in Fig. 3. Here it can be seen that the templet is securely clamped in a holder on the chuck, and the outermost points are checked with a dial indicator to insure that the small radii on the ends are parallel with the axis of the grinding wheel spindle.

The tracer point is then guided along this contour, so that the diamond produces a concave form in the wheel, as seen in Fig. 4. This form, of course, will produce a convex shape on the

Fig. 3. A sample work-piece is set up in a templet-holder on the chuck of the "Dupliform" grinder preparatory to dressing the wheel for form-grinding die

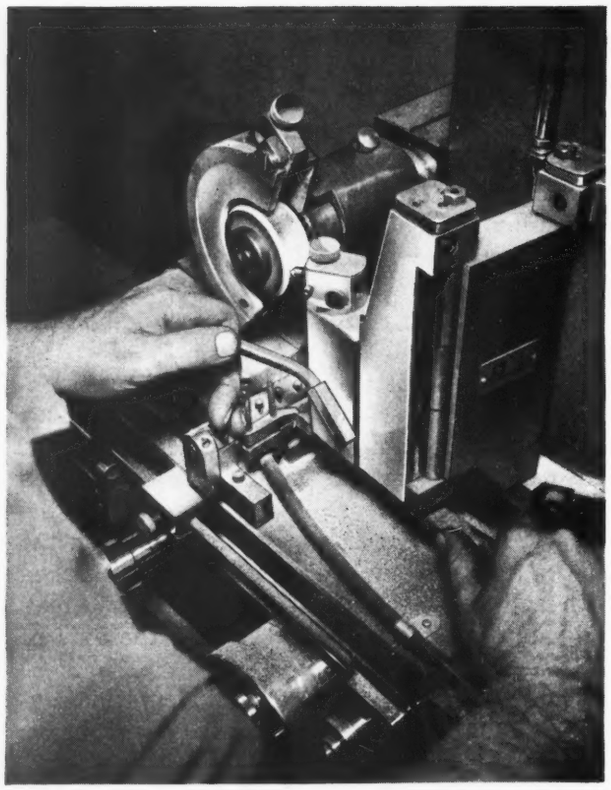
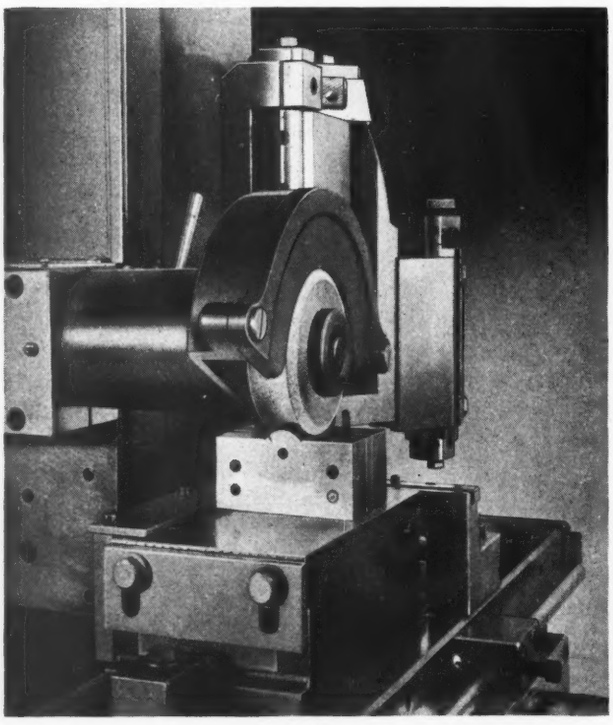


Fig. 4. Using the sample work-piece shown in Fig. 3 as a templet, a tracer is guided by hand across its contour to produce the form in the wheel

Fig. 5. Grinding the convex die, stripper, and punch-holder sections after dressing the wheel. Although coolant is used profusely in this operation, it is not shown here, for purposes of clarity



work. In this case, the entire form, consisting of three radii tangent to two angles and having a total width of slightly over 1 inch, was dressed in a wheel 1 1/8 inches wide.

Using a 4- to 5-inch diameter wheel, a spindle speed of 4200 R.P.M. is employed in grinding the convex assemblies, as shown in Fig. 5. A feed of 0.0001 to 0.0002 inch per stroke was used for this operation, as well as for finish-grinding later. In all these form-grinding operations, coolant is used profusely. Since both sides of the convex assembly were previously ground square, the work may be turned end for end several times during the form-grinding in order to maintain the form in the center of the block. When approximately 0.002 inch of stock is left for finish-grinding, the wheel is redressed after the contour of the tracer point has been checked with that of the diamond.

The correction of the tracer nose to conform with the shape of the diamond is a simple operation, and one that takes very little time. First, the wheel is trued relative to some portion of the templet. Then the unit holding the diamond and tracer is removed from the dresser body, as shown in Fig. 6, and turned around so that the positions of the diamond and tracer are reversed. When the holder is replaced in the dresser body, the diamond is turned on its axis about a point on the templet, which results in the tracer point moving in a similar arc on the face of the trued wheel. Thus the tracer nose is ground to the same shape as the diamond point, so that in subsequent dressing operations the form of the templet will be duplicated exactly in the wheel.

Inasmuch as the fit between the punch and the die is the real measure of accuracy to which the tools are made, it is of the utmost importance that a uniform clearance of predetermined value be maintained between these members. This is especially true where thin stock is to be worked in a die, since little or no clearance can be allowed and absolutely no burrs are permitted.

In this set of tools, which is used for making 3 per cent silicon-steel pole shoes, 0.018 inch thick, about 0.0003 inch clearance on a side is permitted between the punch and die. To obtain this clearance at all points around the entire contour, the tracer is ground so that it is 0.0003 inch shorter than the diamond, measured across the point of the diamond and the micrometer block behind it, and from the tip of the tracer to a block behind it. This difference is held accurately by using a micrometer feed on the machine for feeding the tracer into the wheel. The same procedure is followed when it is desired to leave a specific amount of stock for finish-grinding.

In finishing operations, where the wheel must be fed to the work vertically in tenths of thousandths of an inch, a micrometer rod is provided for controlling the wheel feed, which is measured by a dial indicator graduated in tenths of thousandths of an inch. This feature also permits removing the wheel from the work and returning it again to precisely the original position. The same procedure employed in rough form-grinding is followed in finishing this assembly, the form being kept central by turning the work end for end several times.

During a form-grinding operation, the form being produced can be checked constantly or as needed by removing the work from the machine and placing it in a comparator or on a surface plate, since it can always be replaced in exactly the same position on the chuck.

The method followed in grinding the concave section of the die and stripper is identical to that employed in grinding the convex section.

The grinding of the blanking punch will now be described. Having previously been rough-ground while soft, the pilot-hole reamed, and the blank hardened, the punch block is now placed on the chuck, resting on one of the wide surfaces, and ground to establish a primary locating surface. Only the scale is removed in this operation. Two pins are then inserted in the reamed hole, one at each end, as before, for locating purposes, and the newly ground surface is clamped to an angle-plate so that the upper edge of the block extends slightly above the plate.

Next, a dial indicator is employed to check the parallelism of the pins with a reference surface on the chuck—in this case, the surface plate on which the angle-plate rests. The uppermost surface is then ground parallel to the pins, after which the primary locating surface is reground, using the newly ground surface to locate from. This provides two planes square and parallel to each other and parallel to the axis of the hole.

The remaining two sides are handled in the same manner, after which those sides are ground where stock removal is required to position the hole relative to the die according to specifications. About 0.003 inch of stock is left for form-grinding.

In dressing the wheel for form-grinding the punch, the stripper is used as a templet, since it was made first, as part of the die assembly. The stripper, being somewhat thinner than the die sections, is more conveniently placed in the templet-holder. The back edge of the templet-holder is parallel with the wheel-spindle, and since the stripper surfaces were ground square and parallel to each other, the stripper can be located against this back edge and a dial indi-

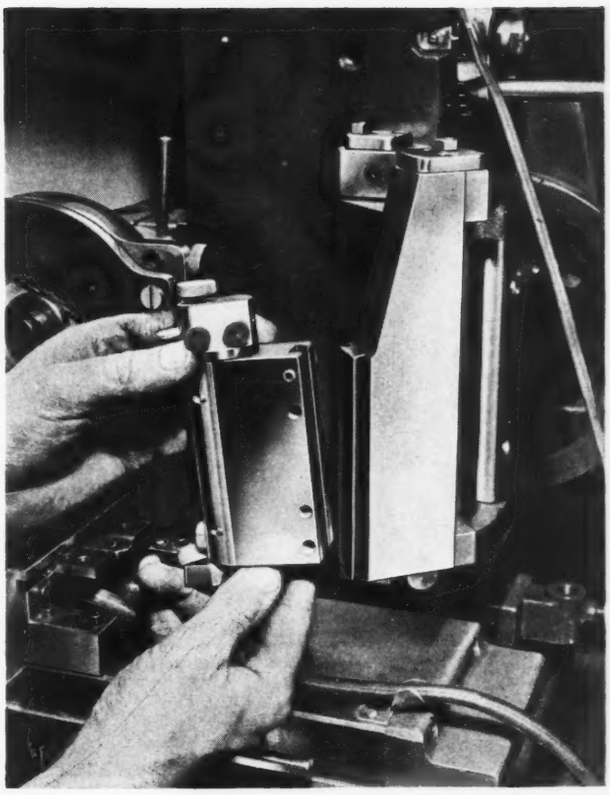
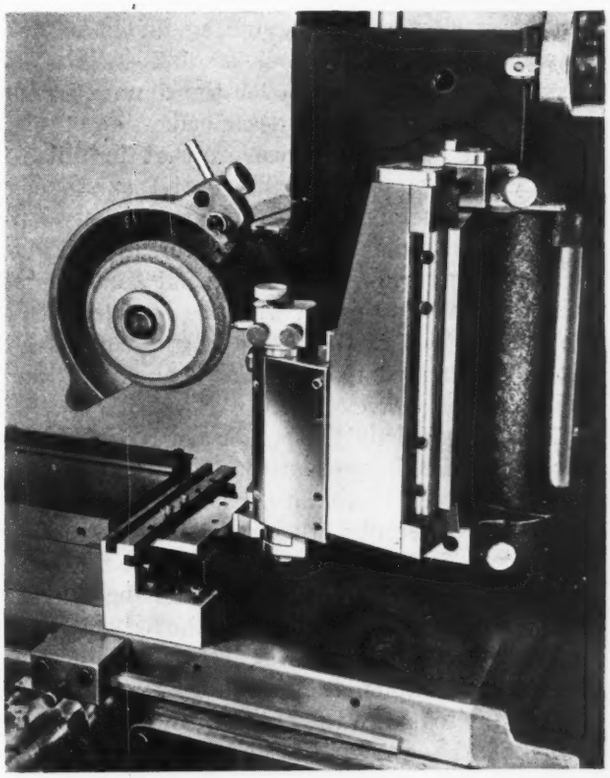


Fig. 6. Removing the diamond and tracer unit from the dresser body preparatory to correcting the tracer contour relative to the shape of the diamond point

Fig. 7. A convex stripper is employed as a templet for dressing wheel to form concave shape in punch



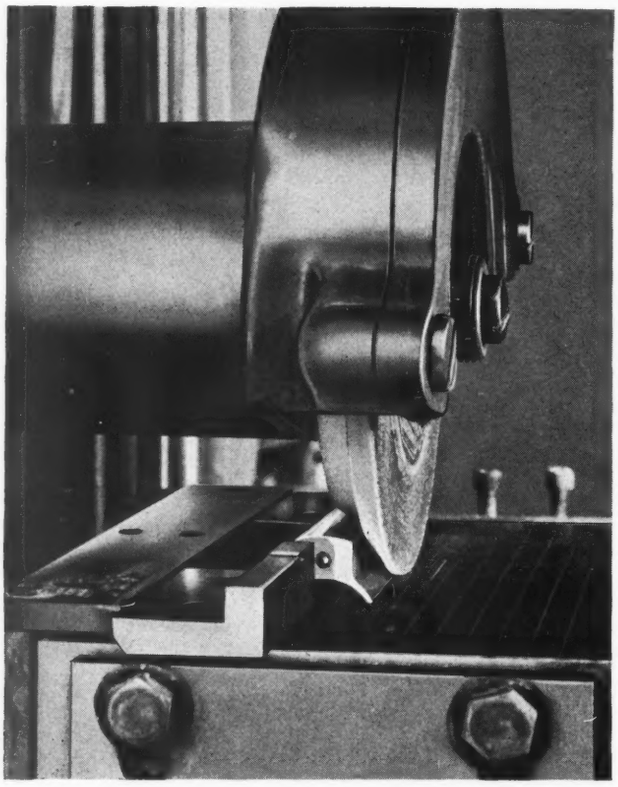


Fig. 8. Form-grinding the convex section of the punch with half of the shape dressed in the wheel

cator used along the front of the stripper to insure that the set-up is correct.

Using the convex stripper as the first templet, Fig. 7, the wheel is dressed for rough-grinding the concave form in one side of the punch. The rough-ground form leaves approximately 0.002 inch of stock for finish-grinding. This is accomplished by maintaining a differential between the measurements over the diamond and the tracer, as previously described.

It should be noted, however, that in finish-grinding the punch, no differential exists between these members, since clearance between the punch and die was allowed for in making the die. By turning the blank end for end to maintain the hole central with the form, the entire concave side of the punch is ground, finish-grinding being completed before changing the set-up for the convex side.

The convex side of the punch, not having been rough-machined, presents a relatively large amount of stock to remove. Using the concave stripper as a templet, the wheel is dressed for grinding half the form, overlapping at the center, Fig. 8. Flash at the point where the convex and concave sections meet is removed with an oilstone after finish-grinding. Upon completion of these operations, the punch is fitted to the die, and the tools are ready to put into the press.

One of the outstanding advantages of this method of diemaking is the interchangeability of the die components. For example, when a die is worn, the punch-holder can be used to replace it, the die then being employed to hold the punch. Or in the case of relatively thin dies that have become worn, the stripper can be employed for this purpose.

A greater depth of land can be used in dies made by this method because the form is precision-ground; moreover, the ground stripper maintains perfect alignment between the punch and die, thereby considerably increasing the life of the tools.

* * *

Drafting Standards Issued for Aluminum Extruded Products

A new manual of drafting standards for aluminum extrusions has been issued by the Extruded Products Division of the Aluminum Association. The purpose of the manual is to outline certain basic practices that are necessary for extruded products, and to standardize those practices as far as feasible.

The production of aluminum extrusions expanded greatly during World War II, and these products have proved useful in an increasing variety of applications since the war. Extrusion section drawings are being constantly exchanged between users and producers, and therefore the preparation of drawings in conformity with the new standards should be beneficial to both. Basic methods of dimensioning, for example, are important to the producer to enable him to maintain reasonable efficiency in the manufacture of extrusion tools and in the inspection of extruded material. Adoption of these dimensioning methods by the user will help insure his obtaining a suitable and economical product.

The manual begins with definitions and identifications of aluminum extruded products. Later sections cover such topics as standard tolerances, proper dimensioning, and standard abbreviations. Recommendations on arrangement and lettering of drawings are also given.

The booklet contains 52 pages, 6 by 9 inches, and includes many tables. Single copies will be supplied without charge to individuals in the United States and Canada requesting them on a business letter-head. Requests should be directed to the Aluminum Association, 420 Lexington Ave., New York 17, N. Y.

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One ton of high-carbon, cold-rolled strip steel produces a million safety razor blades.

Some New Concepts in Bending

(*Continued from Page 152*)

are used for wrap-around type refrigerator coils. The cross-section of such a part is of the same shape throughout, but the straight sections of the coil may vary in length.

The set-up shown diagrammatically in Fig. 3, which operates on the principle of the taffy-puller and is still in the development stage, may be employed for work of this type. Such a machine would be provided with two arms, one above the other, with a radius-block die on one end of each arm, as indicated at *A* and *B*. Both arms would rotate clockwise, as indicated by the arrows, and at the same speed.

The arms would be arranged so that the arcs which they circumscribe would be tangent to each other at one point. In other words, when the die on arm *B* has been rotated through 180 degrees, it would occupy the position in which the die on arm *A* is shown. The arms would be of different and adjustable lengths, but the point of tangency would have to be maintained at all times. This could be accomplished by moving the drive-shaft for the larger arm toward or away from the drive-shaft for the smaller arm, depending upon the length of the longer arm. By feeding straight stock into the machine, coils could be formed automatically having a length equal to the maximum distance between the two dies, and a width equal to twice the length of arm *A*.

Serpentine-shaped coils can be formed rapidly on a double-head type of bending machine, as indicated in Fig. 4. Two dies are generally employed, the dies being mounted on a sliding head and a rotary bending head. The sliding head may be manually controlled or actuated by hydraulic or pneumatic means. First, the position of one die *A* is adjusted by means of the cross-slide until it is in the center of the bending head; the work is then fed between dies *A* and *B*, and the bending head is rotated to complete the first bend, as shown from top to bottom at the left in the illustration.

After reversing the direction of the bending head, the work is again fed between the dies, as seen at the upper right. Next, the cross-slide is adjusted, this time to place die *B* in the center of the bending head. The bending head is then rotated, counter-clockwise, to complete the reverse bend. This cycle can be repeated until the desired number of bends are completed.

This bending device can be used either as a compression or a draw bender, and an internal mandrel can be employed where very small radii must be formed. When used as a compression type machine, a clamp is provided to prevent creepage during bending. In draw bending, the dies are split into upper and lower halves so that they may be clamped together to hold the part being bent.

This device, as used for both draw and compression bending, is patented by the Pedrick Tool & Machine Co. It is expressly designed for high-production machines, and is used to produce four or five coils per minute, each of which has from ten to twelve bends. High accuracy can be maintained on over-all dimensions, radii tolerances, and distances between bends. The highest production thus far obtained on a machine of this type is 5000 bends per hour.

Another interesting machine that has been developed recently is a combination of the roll and die type machines. When it is necessary to bend a large-diameter pipe or tube to a small radius, it is sometimes possible to roll it in a pyramid-roll machine to as small a radius as possible and then die-bend it to the finished size. Such a procedure necessitates the use of two different machines. However, if a standard compression type bending machine is equipped with two motors, one on the central spindle and the second on the faceplate, the machine can be operated as a roll-bender when the spindle is rotated, and as a die-bender when the faceplate is revolved.

* * *

How Hot-Working Improves Properties of Metal

A pamphlet entitled "Metal Quality—How Hot-Working Improves Properties of Metals" has been published by the Drop Forging Association, 605 Hanna Bldg., Cleveland 15, Ohio. Considerable information is presented in this booklet on the development of strength and toughness in forgings, and a complete description is given of the hot-working process. The successive steps in this process—from the ingot through the billet and bar stage to the finished forging—and their effect on the structure of the steel are described in detail. Different methods and designs of dies for producing a wide variety of forgings are clearly explained, and the economic and material advantages of forgings are discussed.

Defense-Program Problems Discussed

PROBLEMS of the machine tool industry that are developing as a result of the nation's defense program received first consideration at the forty-ninth annual meeting of the National Machine Tool Builders' Association, held at the Royal York Hotel, Toronto, Canada, October 11 to 13, inclusive. In his address to the Association, David Ayr, president, pointed out that, in the history of the machine tool industry, there had seldom been such a reversal, business-wise, as had taken place during the last year. At the fall meeting a year ago, the industry had experienced a decline in machine tool sales which had been constant since the end of the war. Today, most companies cannot promise deliveries under five or six months. The problem the machine tool industry faces is to meet the requirements of a war production program in such a way that the machine tool industry will not again be accused of being the bottleneck of war production.

Mr. Ayr stated that the orders for machine tools which are now flooding the industry have not been war orders. They have been almost entirely replacement orders, which manufacturers should have received long ago but which had been postponed because of government depreciation policies and other factors. The Korean crisis served to precipitate the placing of the orders; manufacturers suddenly realized the difficulties that might be experienced in obtaining machine tools for peacetime purposes in the event that the machine tool industry became involved in a war production program.

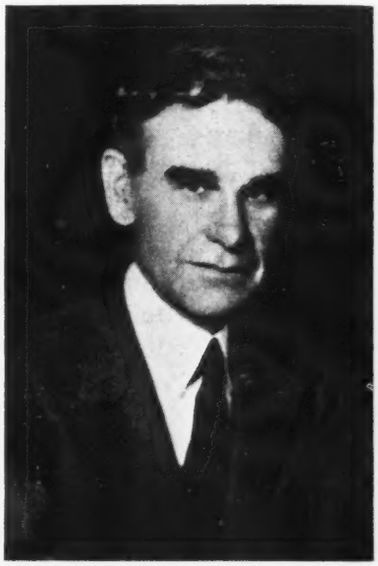
L. D. McDonald, chairman of the Committee on Government Relations and executive vice-president of the Warner & Swasey Co., called attention to the difficulties that the machine tool industry may encounter in obtaining steel for its requirements. It is understood that the military production program will probably take 30 per cent of the nation's steel output. All other industries will be competing for the remaining 70 per cent. Mr. McDonald pointed out that obviously, in any military production program, machine tools should come first, because everything required for fighting must be made with the aid of these machines.

Mr. McDonald also stressed the fact that, while the war profits of the machine tool industry should be subject to renegotiation, it is not fair, because of unusual conditions relating to machine tools, to consider the profits made during a military production period without regard to the depression suffered by the industry when the emergency is over and the machines that had been built for the defense of the country glut the markets.

In his paper "Will the Industry Sell, or Accept Orders?" Swan E. Bergstrom, chairman of the

Newly elected officers of the National Machine Tool Builders' Association. (Left to Right) President, Richard E. LeBlond; first vice-president, Frederick S. Blackall, Jr.; second vice-president, Swan E. Bergstrom

by Machine Tool Builders at Toronto



Moffet Studio

(Left to Right) Jerome A. Raterman, re-elected treasurer of the National Machine Tool Builders' Association; Edward W. Miller and Francis J. Trecker, newly elected directors

Sales and Service Committee, and vice-president, Cincinnati Milling and Grinding Machines, Inc., emphasized the idea that the machine tool industry should constantly strive for modernization. He pointed out that it is easy when business is good to forget that then is the time to plan a sound selling program for the future. He stressed the fact that selling organizations should not be allowed to let down in their efforts to promote replacement of old equipment; that the need for selling is just as important today as it was yesterday and will be in the future; and that the salesman's part in business is as fundamental now as it is in any normal period.

Mr. Bergstrom stated that if it is sound for management to adopt a long-range sustained policy of constantly reappraising productive equipment, then it is equally sound for machine tool builders to train salesmen now for the situation that will exist when the defense program comes to an end. He said that there is grave danger that the easy flow of orders under present conditions will lead sales executives to relax, with the result that they will be unprepared for future problems of a more difficult nature. Mr. Bergstrom declared that American management must be sold this basic idea: "You can't meet the competition of tomorrow with the machine tools of yesterday."

Frank Pensinger, chairman of the Advertising Committee and advertising manager of the Monarch Machine Tool Co., gave a report on the activity of the new committee of which he is chairman. His paper discussed ways in which the advertising men of the industry can help promote the objectives of the Association, and he mentioned the cooperation received from the various trade and technical magazines in publishing editorials and articles relating to the replacement of machine tools. Mr. Pensinger listed the following six sales obstacles that were referred to the Advertising Committee:

1. Inadequate depreciation allowances to provide replacement reserves.
2. Labor's opposition to increased output per man-hour.
3. Pressure of stockholders for dividends.
4. Failure of bankers to appreciate the importance of efficient equipment to a company's successful operation.
5. Dissipation of capital recovered by depreciation instead of earmarking for new equipment.
6. Lack of appreciation of what modern machine tools can do to cut costs.

The last point, Mr. Pensinger asserted—lack of appreciation of what modern machine tools can do to cut costs—is by far the major sales obstacle.

Milburn A. Hollengreen, president of the Landis Tool Co., took as his subject "A Glimpse of Europe," and Alexander S. Keller, former Senior Industry Officer and Executive Officer of the E.C.A. Special Mission to the Netherlands, spoke on "E.C.A. in Action." "Living with Our Neighbors" was the topic of the dinner speaker, Leonard W. Brockington, general counsel for

Gowling, MacTavish, Watt, Osborne and Henderson.

The following officers were elected for the ensuing year: President, Richard E. LeBlond, president of the R. K. LeBlond Machine Tool Co.; first vice-president, Frederick S. Blackall, Jr., president and treasurer of the Taft-Peirce Mfg. Co.; second vice-president, Swan E. Bergstrom; and treasurer, Jerome A. Raterman, president, Monarch Machine Tool Co. Three new directors were elected as follows: Mr. Bergstrom; Edward W. Miller, president of the Fellows Gear Shaper Co.; and Francis J. Trecker, president of the Kearney & Trecker Corporation.

* * *

Spring Design and Quality Control Courses

Courses in spring design and quality control are now being held for the third successive year at the plant of the Hunter Spring Co. in Lansdale, Pa. The sessions of each course, given on alternate weeks, have been designed to present a balanced combination of theoretical background and practical procedures derived from the company's own experience.

The purpose of the spring design course is to promote better spring design and use by a clear-cut analysis of the engineering and manufacturing principles involved. The quality control course is conducted to stimulate awareness and appreciation of the benefits of modern quality control procedures by a study of techniques already in use.

The schedule of each course, its purpose, instructors, and subject matter are given in the Hunter Spring Bulletin, a copy of which can be obtained by writing Director of Training Courses, Hunter Spring Co., Lansdale, Pa.

* * *

Film Showing Use of Industrial Advertising in a Mobilization Economy

"The Radar of Selling," a film showing how industrial advertising helps make sales, will shortly be supplemented with an epilogue suggesting how to make best use of this form of advertising in a mobilization economy. The supplementary film, also 16 millimeters in color and sound, will tell how to document industrial advertising so as to serve American industry, to aid essential production, and to benefit the companies doing such advertising. "The Radar of Selling" was produced by the National Industrial Advertisers Association in cooperation with the Putnam Publishing Co., Chicago, Ill.

A Plastic that Provides "Internal Vision" for Engineers

A new plastic that can be made into scale models of machine parts and tools is providing "internal vision" for engineers in military, university, and industrial laboratories, according to Westinghouse scientists who developed it.

This "photo-plastic" is aiding researchers in gun factories, airplane-engine plants, arsenals, naval laboratories, and universities in designing stronger machinery and equipment. The three-dimensional scale plastic models enable scientists to get a "portrait in color" of the strains encountered in tools, machine parts, and other objects.

The plastic can be cast in cylindrical or rectangular chunks 8 inches in diameter by 36 inches long. Previous "photo-plastics" were limited to flat pieces not more than 1 1/4 inches thick. One of the major applications of the new material is in the design of breech blocks for big guns. To understand the terrific stresses these parts undergo during firing of the gun, an exact three-dimensional model of the block is built and "loaded" to simulate the stress. When frozen into the material and then viewed through special polarized light, the stress pattern appears as a series of vari-colored lines that tell the scientist where the major stresses are located, in which direction they are acting, and just how great they are. Medical scientists may also find this material of great value, as experimental leg-bone models will enable internal stresses in human bone structure—such as those caused by fractures or heavy blows—to be clearly viewed and analyzed.

The new plastic is a modified form of Fosterite—the tough, waterproof material developed during World War II to seal radio and radar parts against harmful moisture. This plastic is 35 per cent more sensitive than the standard "photo-plastic." As a result, many more stress lines appear when the model, or a slice of it, is viewed through polarized light. Since counting these lines is an essential part of analyzing the stress pattern, the more lines there are, the more accurate the "diagnosis."

* * *

To assist manufacturing concerns in the organization of their standardization work, a private five-day seminar, designed for company representatives, will be held by Dr. John Gaillard, mechanical engineer, of the American Standards Association, on January 22 through 26, at the Engineering Societies' Building in New York. For details, write Dr. Gaillard, 400 W. 118th St., New York 27, N. Y.

Engineering News

Hardness of Single Crystal of Steel Determined by Instrument

An instrument that can determine the hardness of a single crystal of steel is one of numerous new devices being used by steel company technicians in their widely varied activities. Known as the "Microhardness Tester," the instrument is capable of taking hardness readings at three spots within the width of a human hair.

The technicians are also now using auto-radiograms, which are patterns produced on photographic plates by the action of radioactive elements, to supplement microscopic studies. The Geiger counter, famed for its ability to detect uranium and other radioactive substances, has been adapted to a quick, accurate way of analyzing steel. Another new instrument is the "recording torque magnetometer." It measures the ability of steel to stretch uniformly under the action of dies.

High-speed color photography has been employed to study the physical reactions inside the hearth of a blast furnace. The pictures, taken at a speed of 3000 frames a second, show the travel of incandescent particles of raw materials estimated to be moving at 135 miles an hour.

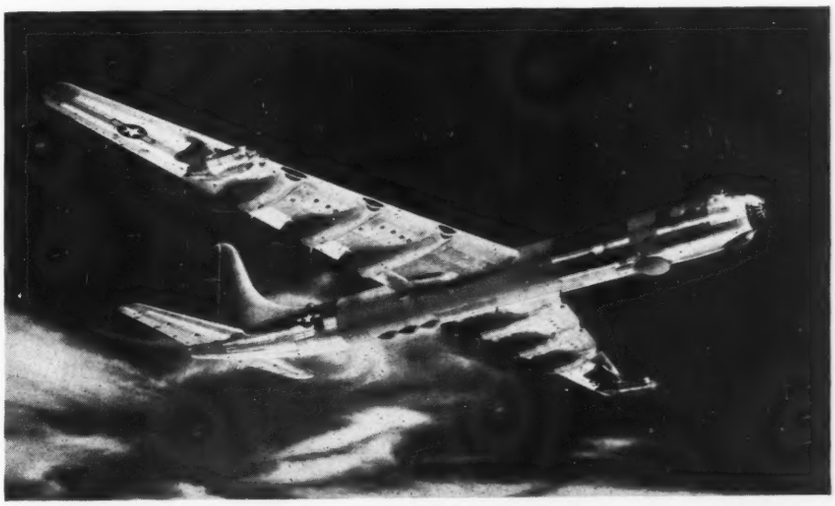
New Superchargers for Gas and Diesel Engines from 1200 to 2500 H.P.

The largest capacity engine superchargers ever to be produced in this hemisphere are now being built by the Cooper-Bessemer Corporation at its plant in Mount Vernon, Ohio. Although designed specifically for Cooper-Bessemer Type LS and LSV engines, the new superchargers are able to handle the requirements of any gas or Diesel engine from 1200 to 2500 H.P.

Liquid Nitrogen Speeds up Impact Pulverization

Rapid, effective pulverization of materials that were previously hard or impossible to grind can now be accomplished by a method developed by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation. The new technique uses liquid nitrogen, in spray form, to cool the material rapidly to a point of maximum fragility and thereby reduce the amount of energy required for its fracture. So effective is the process that it promises to accelerate the pulverization of mechanically tough or heat-sensitive materials, such as plastics, pharmaceuticals, insecticides, foodstuffs, etc.

The new pulverization process employs the same type of liquid nitrogen as is used industrially in rapidly cooling precision metallic components for shrink fitting. Commercial liquid nitrogen can maintain a temperature as low as —320 degrees F. As a liquid, it can cool a substance more rapidly than solid refrigerants because it is capable of more efficient heat transfer. It can be used in direct contact with other materials because it is inert and passes off as a gas. The high temperature differential between liquid nitrogen and materials at room temperature results in maximum cooling rates.



Convair RB-36D reconnaissance bomber, equipped with the most powerful cameras ever installed in an airplane, is designed to serve as airborne eyes and ears for the Strategic Air Command. Jet-augmented, it operates in the stratosphere and can travel at a speed of over 435 miles per hour. These planes are produced at the Fort Worth, Tex., plant of the Consolidated Vultee Aircraft Corporation

Tracer-Controlled Employed for

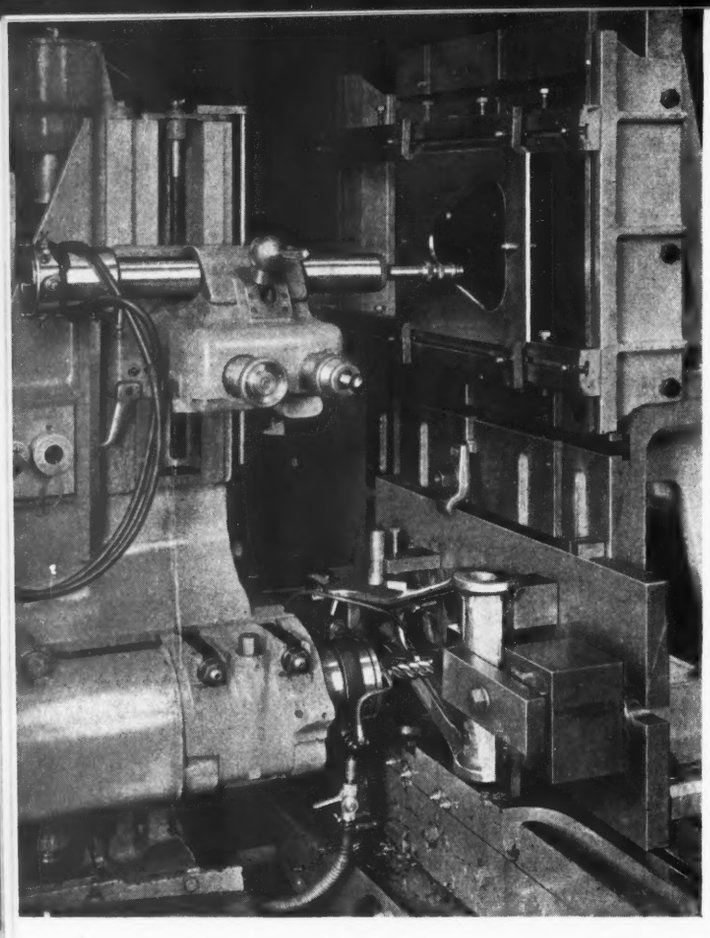


Fig. 1. Aircraft catapult hooks are accurately profile-milled to conform with the contour of a thin metal templet. The vertical and horizontal movements of the cutter are controlled and guided by the profile tracer

AUTOMATIC, tracer-controlled milling is an important factor in the economical production of dies, molds, and other tools and parts. This method of machining irregular contours and reproducing three-dimensional shapes has been extensively applied in toolrooms, tool and die shops, metal pattern shops, and many other places where complex forms must be accurately and economically produced.

Keller machines, built by the Pratt & Whitney Division of the Niles-Bement-Pond Co., West Hartford, Conn., are widely used for work of this type. These machines are electrically operated, and employ a sensitive tracer which passes over a master form to actuate a cutter that duplicates, in the work, the path followed by the tracer.

The work does not have to be high-volume production in order to be economically handled on these machines. Short-run production and even single pieces can be duplicated as economically as large-quantity work because the accuracy attained is such that very little hand finishing is required and the machines are quickly and easily set up. Templets, or masters, can be made cheaply from wood, plastic, or artificial stone, or they may be constructed of thin sheet metal. Often, broken dies or finished tools that are to be duplicated can be used as masters.

The tracer on all Keller machines is mounted horizontally in a bracket on a vertical slide. This slide also carries a horizontally mounted cutter-

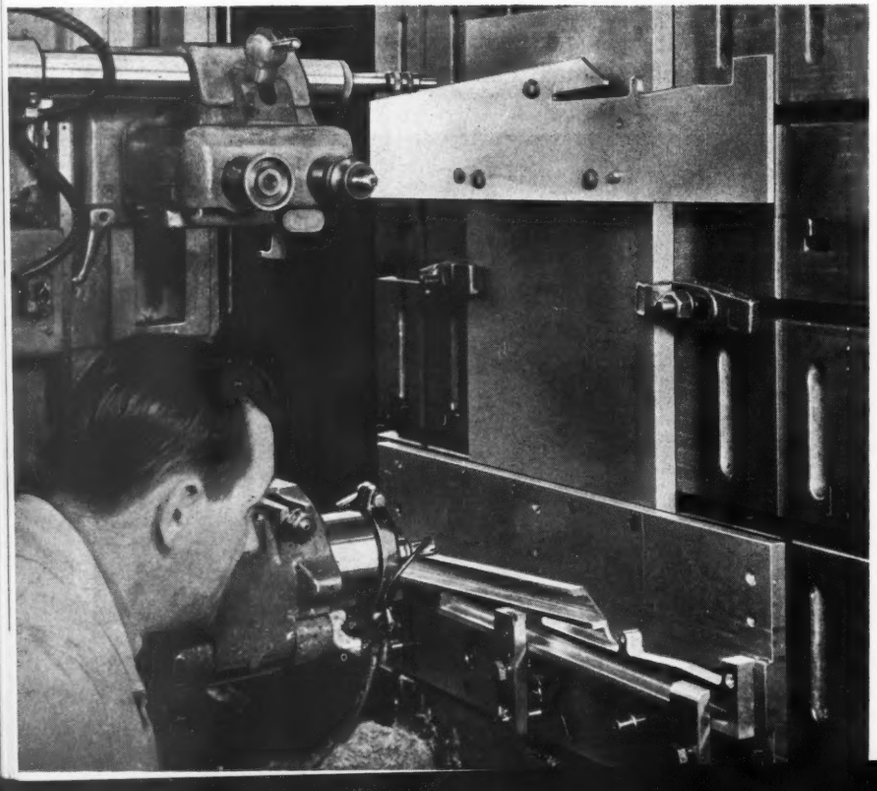


Fig. 2. The contour of this aircraft wing flap track is milled from solid aluminum stock by using the thin templet shown

Milling Machines Repetitive Work

spindle under the tracer. Vertical, horizontal, and transverse adjustment is provided for the tracer, while the cutter-spindle is adjustable in the transverse direction. The adjustment range of the tracer, spindle, and master-holding fixture is sufficient to compensate for a reasonable variation in location between the master and the work without loss of accuracy in reproduction. This considerably simplifies set-up of the machine, since it is unnecessary to locate either the work or the master to any high degree of accuracy.

When the proper position of the cutter relative to the work and of the tracer relative to the master form has been established, the tracer and cutter move in unison, the tracer following the shape of the master form and the cutter duplicating that shape in the work.

One of the two principal tracer-controlled types of operations performed on these machines makes use of a profile tracer which controls and guides only the vertical and horizontal movements of the cutter. In this case, the cutter is set to a given depth before the operation is started, and generally a thin metal templet is used as a master.

Fig. 1 illustrates one of these contour milling operations. Here the inside contour of a triangular opening in a forged-steel (SAE 4130) aircraft catapult hook is profiled. A small lot—thirty-five pieces—was set up and completed at an average rate of fifteen minutes per piece. In Fig. 3, another profiling operation on the same part is shown. A special formed cutter is employed in this operation to machine the hook section. The same number of parts was machined at an average rate of thirty-five minutes apiece.

During profiling, the machine operator guides the tracer point toward the master, and he determines the general direction in which it follows the outline. The tracer point is in continuous contact with the templet as it follows the contour. There are four electrical contact points, 90 degrees apart, at the back end of the tracer corresponding to the vertical movements of the slide and the horizontal movements of the table. A slight pressure of the tracer point against the master is sufficient to de-energize one of these contacts, and additional pressure energizes another.

This changes the direction of travel by exciting relays that control various clutch magnets which govern the direction of rotation of the

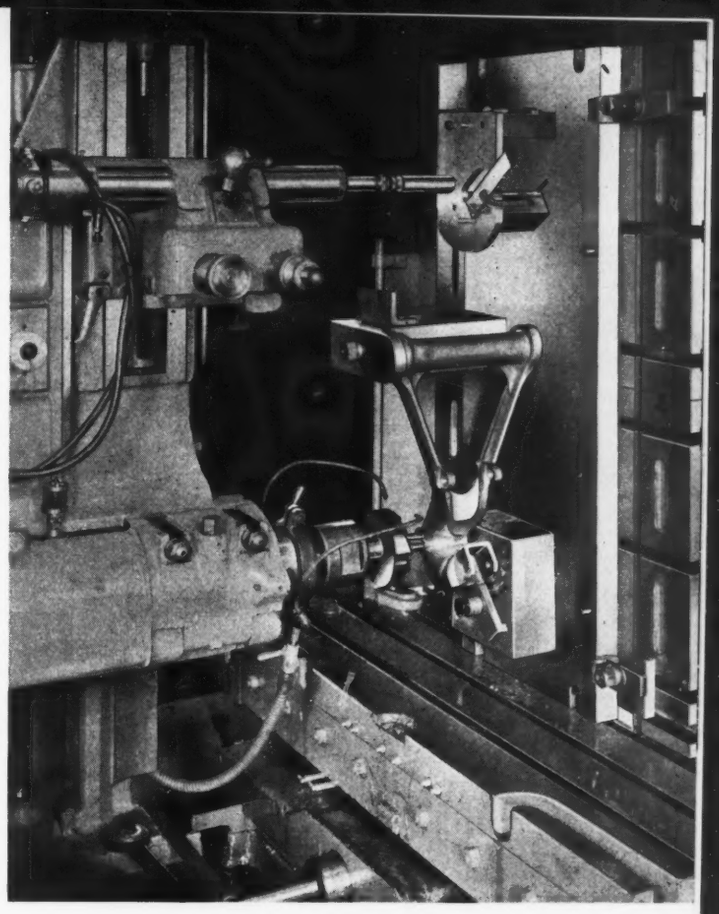
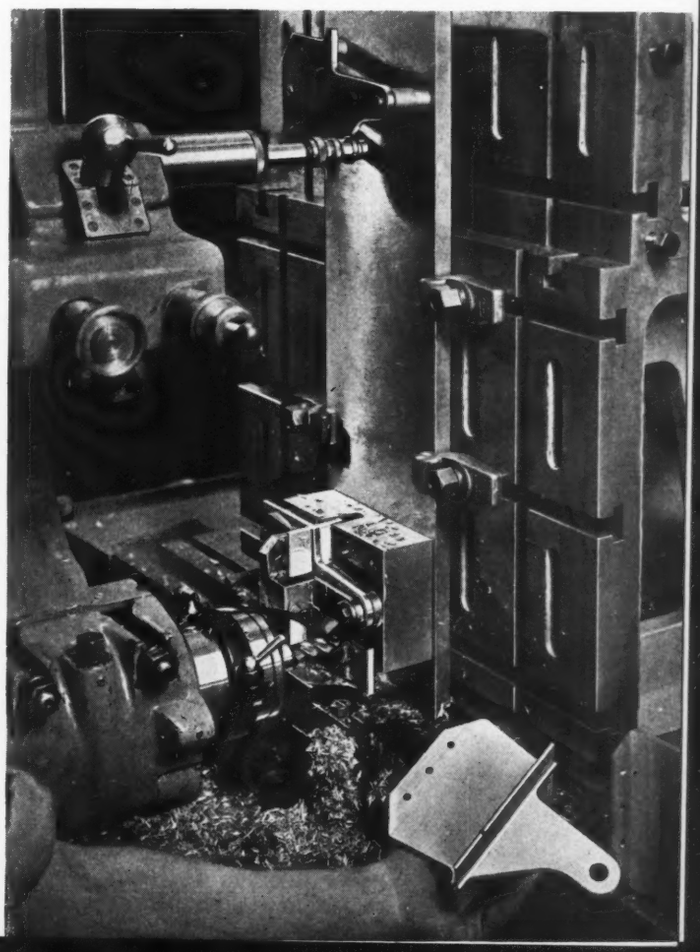


Fig. 3. A special formed cutter is employed to profile-mill the hook section of an aircraft catapult hook

Fig. 4. Seventy of these aircraft fittings were profile-milled at a floor-to-floor rate of four per hour



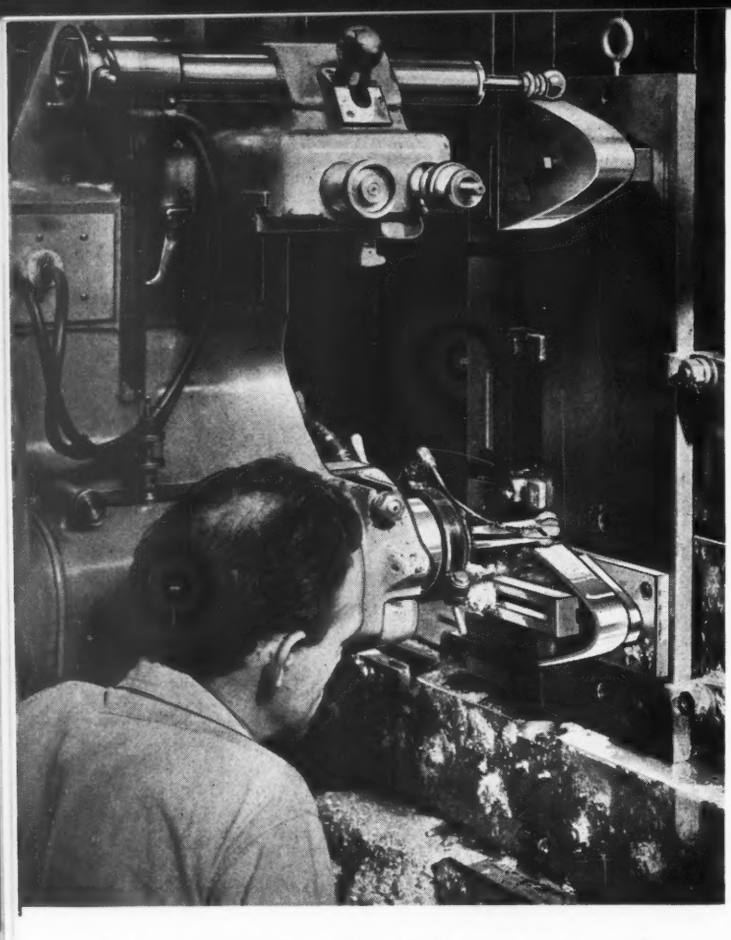
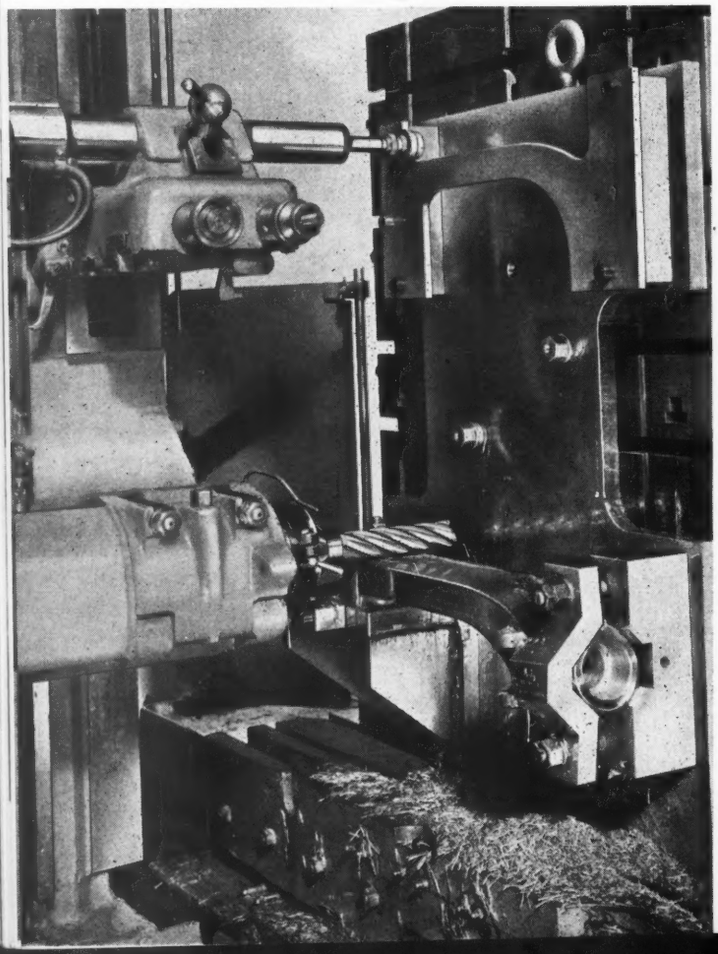


Fig. 5. Because the contour of this part varies in all directions, a ball-shaped cutter is used for profiling

Fig. 6. About 1/4 inch of stock is removed from these forged-steel parts, 500 of which are profile-milled at the rate of twenty minutes a piece



vertical and horizontal lead-screws. The tracer is so sensitive that a movement of 0.001 inch on its point as it bears against the templet will vary the direction of travel. This sensitivity of the tracer is independent of the size of the cutter, the depth of the cut, or the material being worked on.

Another profile milling operation utilizing these facilities is shown in Fig. 2. This job consisted of profiling sixty-six left-hand and sixty-six right-hand aircraft wing flap tracks. The contour was milled in solid aluminum stock at a production rate of one hour and thirty-four minutes each.

Fig. 4 illustrates the profiling of another aluminum aircraft fitting. In this case, a lot of seventy pieces was made to very close tolerances at the rate of fifteen minutes per piece. The set-up illustrated in Fig. 5 shows the profile-milling of magnesium-alloy wing fittings for aircraft. Because of the irregular contour on these parts, a ball-shaped cutter was used, feeding transversely after each pass, and making thirteen separate passes, since the contour varied in the transverse as well as in the longitudinal direction. The seventy parts handled in this lot consisted of thirty-five left-hand and thirty-five right-hand pieces.

Approximately 1/4 inch of stock was removed from the forged-steel (S A E 4130) aircraft main landing gear yoke shown in Fig. 6. In this profiling operation, 500 pieces were produced at a floor-to-floor rate of twenty minutes apiece, using a helical, high-speed steel cutter 1 1/2 inches in diameter and 6 inches long. The total length of cut on each piece for both the top (convex) and bottom (concave) surfaces was 36 inches.

For milling internal cavities, complex external forms, and other three-dimensional work, an automatic tracer is used instead of the profile tracer described. The automatic tracer does not require guidance of the operator, and when the machine is set, it is fully automatic. The machine controls are set so that the tracer covers the surface of the master (or a section of the surface) in a series of parallel vertical or horizontal passes, the lengths of which are determined by the requirements of the job. The length of these passes or strokes is controlled by adjustable horizontal and vertical reversing dogs that maintain uniform lengths of stroke, or by transverse reversing dogs which operate at the surface outline of the cavity or at a predetermined depth within the cavity.

A third control over the stroke length of the tracer is manual, through a reversing switch. At the end of each stroke, an automatic feed movement takes place, the amount of which is

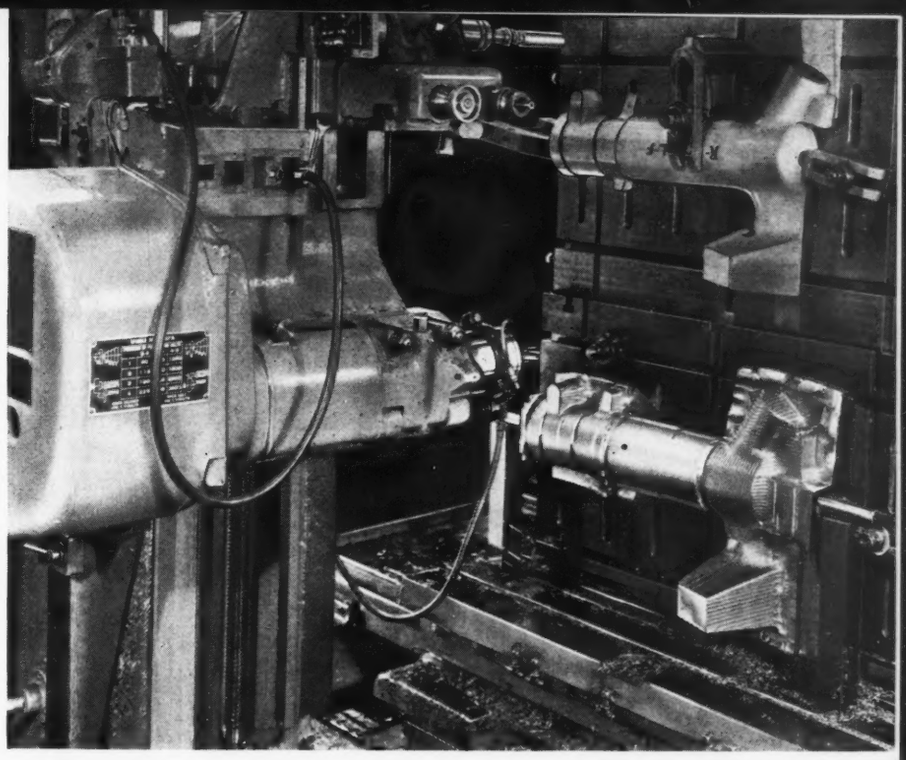


Fig. 7. Three-dimensional milling being performed on a forged model of an aircraft landing gear cylinder

established in advance by means of a feed mechanism set by the operator.

The depth of cut is automatically controlled by the tracer. When the point is not in contact with the master, the vertical slide on which the tracer and cutter are mounted travels in, bringing the cutter into the work. From the moment tracer contact with the master is established, varying degrees of pressure created by the contours over which it passes cause the vertical slide to move in and out accordingly. The automatic tracer responds to either axial or side pressure, and, through relays, it can lock out the horizontal or vertical movements while traveling in or out.

This step-by-step approach of the tracer per-

Fig. 8. High finish and accurate reproduction of form in three-dimensional work are obtained in this set-up, where a built-up wooden model is used as a master

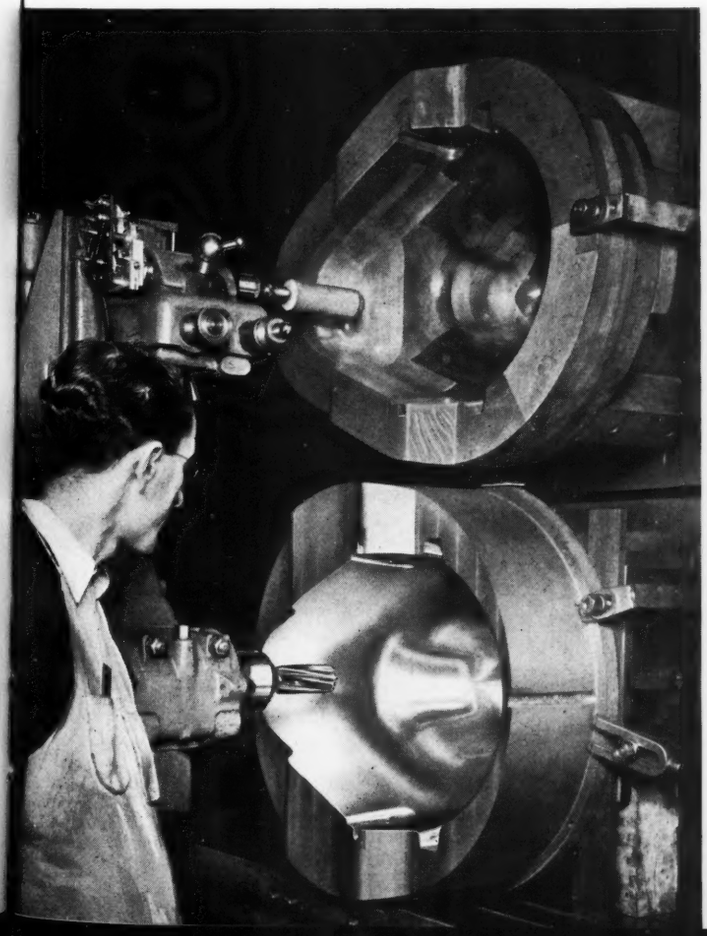
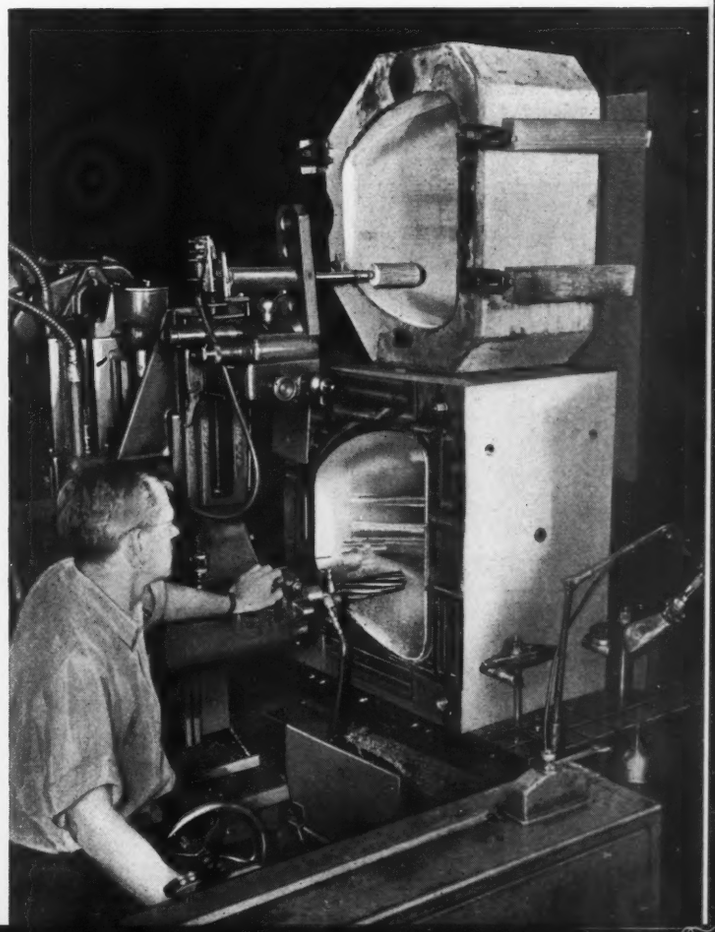


Fig. 9. The mold for a plastic radio cabinet is machined in exact accordance with the form of a plaster model in the three-dimensional milling operation here shown



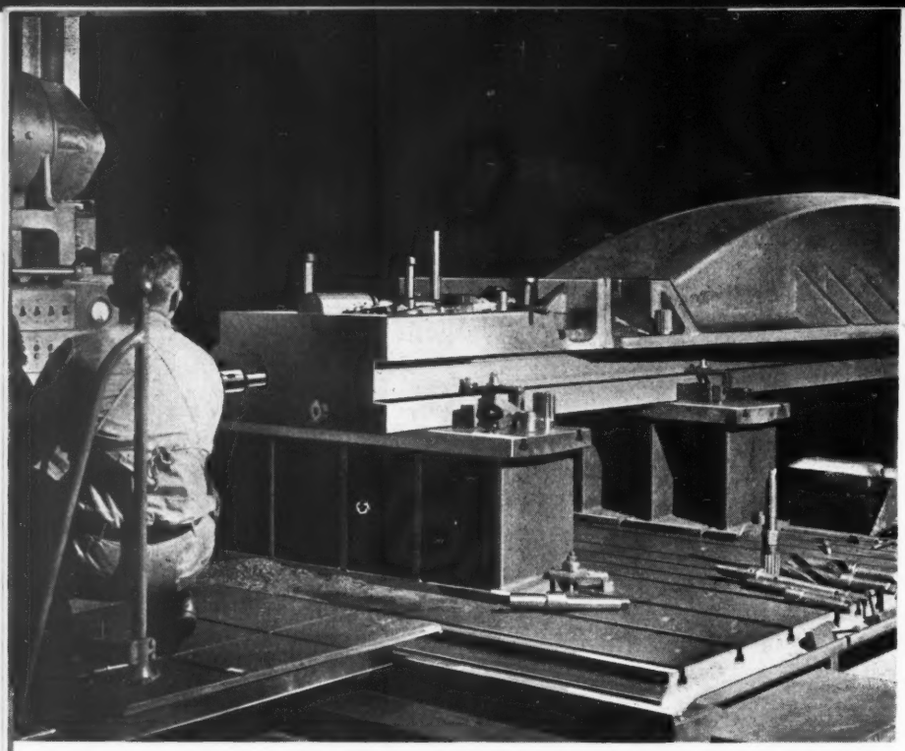


Fig. 10. In this unusual application, holes are drilled, bored, reamed, and tapped in the end of a casting 25 1/2 feet long

mits the cutter to reproduce accurately the complete form of the master, regardless of the perpendicularity of the cavity or the elevation. An example of the type of work performed with this tracer may be seen in Fig. 7. The part is a model of an aircraft landing gear cylinder, and is milled from a steel forging (S A E 4130). It was rough- and finish-machined on one side and then turned over for roughing and finishing the other side. Starting with a 464-pound forging, the finished part weighed 175 pounds.

The finish obtainable and the complexity of form that can be reproduced with these machines are evident from the work illustrated in Fig. 8. Here, a built-up, wooden model is employed as the master form. A typical example of three-dimensional operation is illustrated in Fig. 9, where the deep cavity of a mold for making radio cabinets is being machined to conform with a plaster model.

The versatility of these tracer-controlled milling machines is evident from the application illustrated in Fig. 10. Here neither profiling nor three-dimensional work is performed, the machine being employed for drilling, boring, reaming, and tapping operations at the end of a 12-ton casting. This part is 25 feet 6 inches long.

Another unusual application of the machine may be seen in Fig. 11. In this case, the top surface of a special machined bed of welded construction is finish-machined with a carbide-tipped fly cutter. Other machining operations, such as drilling, reaming, and tapping, can be accomplished without changing the set-up.

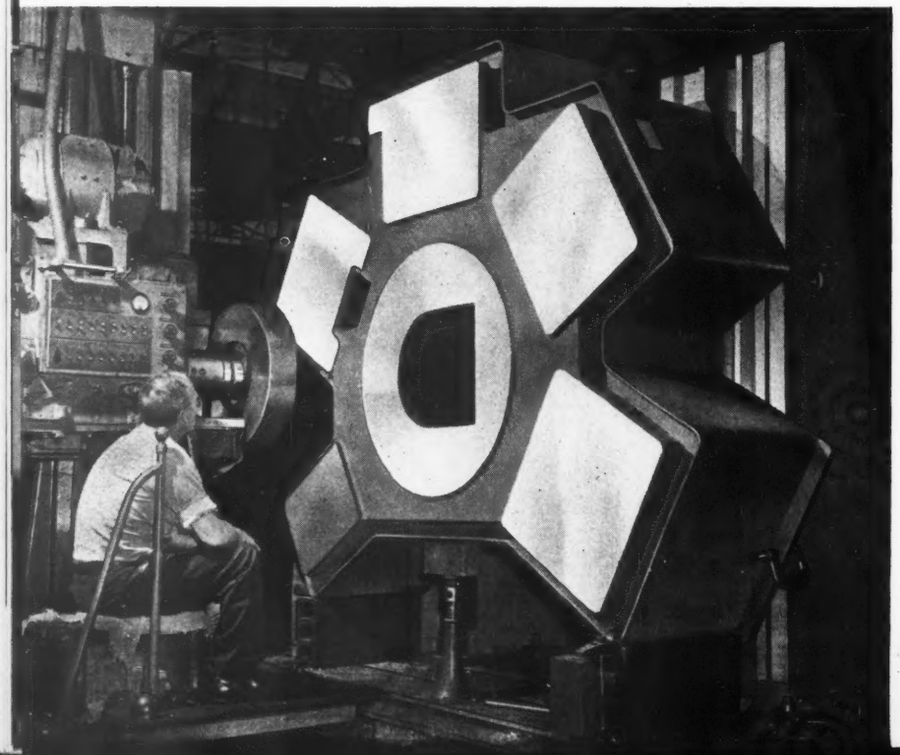


Fig. 11. Finish-machining the top surface of a welded machine bed with a carbide-tipped fly cutter

Selling Problems Discussed by Machine Tool Distributors

AT the twenty-sixth annual meeting of the American Machine Tool Distributors Association, held at Lake Placid, N. Y., September 29 and 30, many problems directly and indirectly pertaining to the selling of machine tools were discussed. After a few brief opening remarks by the president of the Association, O. W. Johaning, of the Colcord-Wright Machinery & Supply Co., St. Louis, Mo., Dan Harrington, of the Harrington-Wilson-Brown Co., New York City, presented a comprehensive address on "Originating the Inquiry." He referred to several methods by means of which inquiries can be stimulated, dwelling particularly on those for which the salesman, himself, is responsible.

He emphasized the necessity for the salesman to study the customer's work and acquaint himself thoroughly with his needs. This can be done, he said, only by frequent visits to the customer's shop, and careful observation of the product manufactured and the methods and equipment used. This will enable him to suggest more productive or more accurate equipment and cost-reducing methods. Sometimes entirely different machines from those in use may be suggested to the customer's advantage.

During these shop visits, the salesman should cultivate the acquaintance of foremen and machine operators, both of which groups will often be able to furnish ideas and suggestions for improving the quality and quantity of the product. The salesman should always endeavor to discuss with the prospective customer new equipment and methods recently introduced, even though he may not be directly interested in their sale, as the passing along of such information will create good will on the part of the prospective buyer of the salesman's own equipment, and will indicate that the salesman is well informed and keeps up to date on all new developments in the machinery line.

Another point that the salesman should never overlook is to obtain performance data on installations made in other customers' plants, together with permission to use such data with or without the names of the customers. Nothing is more convincing than information of what actually has been done in everyday work elsewhere.

E. B. MacDonald, newly elected president of American Machine Tool Distributors Association

High-Speed Photography for Industrial Purposes

A most interesting and informative presentation of what can be done today with high-speed photography was made by Fordyce Tuttle, of the Eastman Kodak Co., Rochester, N. Y. Motion pictures were shown at slow speed that had been photographed at the rate of 700 to 1200 per second. Many unusual examples of high-speed photography were presented, and reference was made to methods by which actually millions of exposures can be made per second.

The trends in machine tool electrification were dealt with by C. M. Rhoades, of the General Electric Co., Schenectady, N. Y. The speaker pointed out, by means of diagrams, the increase in total horsepower of electric motors now being used in driving machine tools compared with a few years ago. He then reviewed the different kinds of motors employed for machine tool drives, and pointed out their applications. Various types of drives were discussed, special emphasis being placed on adjustable-speed drives, and several recently developed special drives were described. The characteristics of brakes, clutches, and couplings were also referred to, and numerous examples were shown on the screen to clarify the points made. One unusual application explained was the use of magnetic tape for duplication of formed machined parts.

The great need for modernization of equipment in many machine shops was emphasized in a paper entitled "New Machinery for Old," by Robert L. Giebel, of Giebel, Inc., New York City. He reviewed briefly the chief reasons why machine shop equipment becomes obsolete, and the points that should be stressed in order to interest management in better production equipment.

An unusual approach to the sales problems facing the machine tool salesman was presented by Allan H. Mogensen, who stressed two points, which he suggested that everyone concerned with industrial relations, and salesmen especially, should take note of. These were: (1) We all resist change. (2) We all resent criticism. Endeavor to make the person you wish to convince suggest, himself, the change you have in mind; and let him present, as his own idea, the criticism of his methods and equipment that it is to his interest to recognize. Mr. Mogensen laid great stress on the fact that, in most industrial plants, both men and machines can develop higher efficiency, and also that, by motion study, industrial output can usually be greatly increased, even where it may have been believed that satisfactory production has already been achieved.

Officers elected for the ensuing year are as follows: President, E. B. MacDonald, Syracuse Supply Co., Syracuse, N. Y.; vice-president, E. J. Seifreat, Seifreat-Elstad Machinery Co., Dayton, Ohio; second vice-president, John M. Riordan, Riordan Machinery Co., Detroit, Mich; and secretary-treasurer, George B. McClennen, Delta Equipment Co., Philadelphia, Pa. Members selected for the Executive Committee for terms expiring in 1953 are: Arlington Nuetzel, Blackman & Nuetzel Machinery Co., St. Louis, Mo.; Thomas M. Rees, Rees Machinery Co., Pittsburgh, Pa.; and Thomas R. Rudel, Rudel Machinery Co., Inc., New York, N. Y. Frederick A. Brechter, Vandyck Churchill Co., New York, N. Y., was selected to fill the unexpired term of Mr. Riordan.

* * *

Shortage of Engineering Graduates

The United States faces a potential shortage of engineering graduates, according to Dr. William C. Knopf, Jr., assistant dean of the Technological Institute at Northwestern University, Evanston, Ill., and chairman of the Illinois-Indiana section of the American Society for Engineering Education. "It is evident," Dr. Knopf says, "that there will be acute shortages of engineering personnel in the near future because of the increased need for engineers created by mobilization activities. The gravity of the outlook is increased by sharp reductions in the numbers of prospective engineering graduates for the next five years. Unless there is a marked increase, either in the percentage of high school graduates who go to college or in the percentage of college freshmen who enroll in engineering, there will be further reductions beyond 1953."

Taps for Tapping Aluminum Alloys

Taps used for steel or brass are unsuitable for aluminum alloys as taps for aluminum require a top rake on the cutting edge, according to the *Technical Advisor*, published by the Reynolds Metals Co., Louisville, Ky.

Spiral-fluted taps are better for aluminum than are straight-fluted designs. A right-hand spiral tap having a spiral angle of about 40 degrees is recommended for blind holes where chip space is restricted, while a "gun" tap may be used on through holes or on blind holes where there is ample chip space at the bottom. The latter type of tap is more sturdy and permits better passage of lubricant. Since the chips are pushed ahead of the tool, the flutes remain empty, thus permitting them to be shallower and the web heavier and sturdier.

Spiral-fluted taps are quite successful and provide some side rake, which may be augmented by grinding the leading edge of the lands to an angle of about 5 degrees relative to the axis of the tap up about as far as the second or third full thread, thereby giving the tap a freer cutting action.

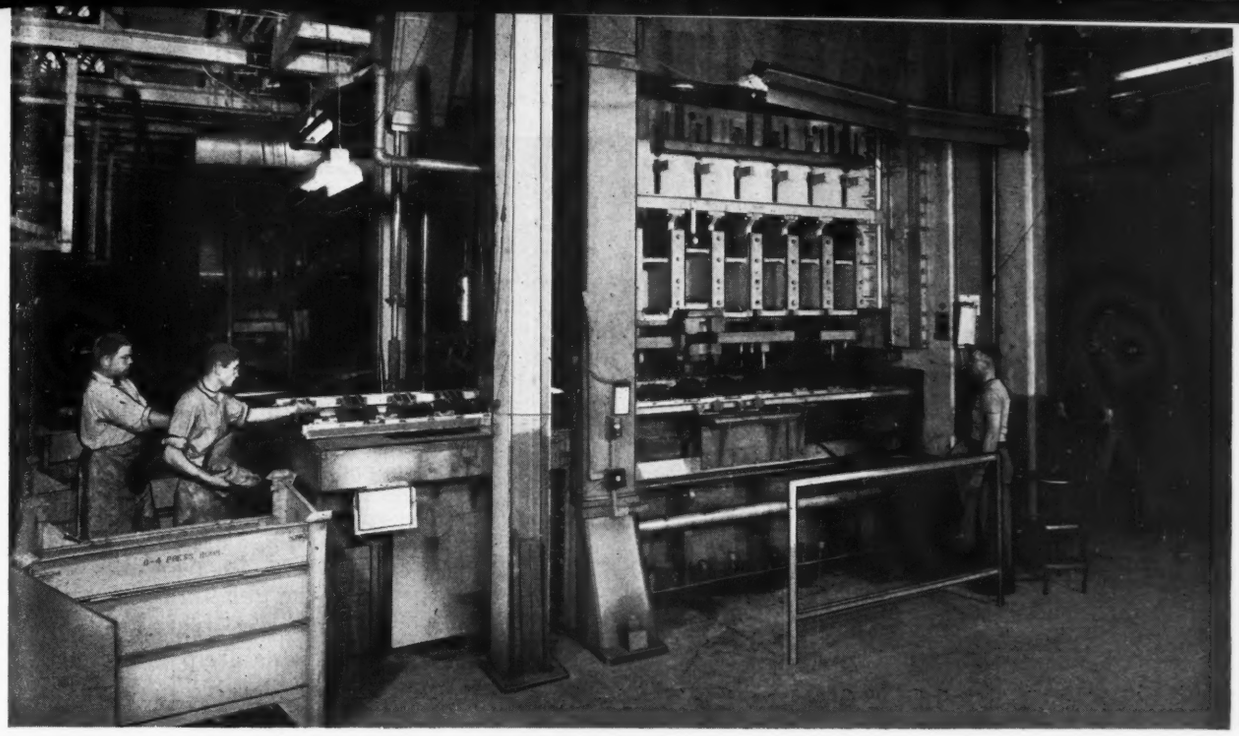
The cutting edges should be under-cut to give a cutting angle of about 45 degrees and the backs of the lands should be radial or slightly undercut to prevent tearing and clogging on backing out. The lands should be comparatively narrow; the total land width should usually not exceed one-fourth of the tap circumference.

For better chip removal, the flutes of all taps should be highly polished.

* * *

Explosion Hazards of Flammable Liquids, Gases, and Solids

Information concerning the fire and explosion hazards of flammable liquids, gases, and solids found in industrial plants is given in a bulletin recently published by the Engineering Division of the Associated Factory Mutual Fire Insurance Companies. This publication is a valuable source book for fire prevention engineers. It is entitled, "Properties of Flammable Liquids, Gases, and Solids," and contains a table of more than 650 flammable materials, giving the chemical formula, flash point, explosive limits, auto-ignition temperature, specific gravity, and other data for each. Those interested can obtain copies from the Engineering Division of the Associated Factory Mutual Fire Insurance Companies, 184 High St., Boston 10, Mass.



Forming Washing Machine Legs on a Transfer Type Press

Washing Machine Legs are Formed from Developed Blanks of 16-Gage (0.0598 Inch Thick) Steel at Rates up to 960 per Hour on a Unique, Six-Station Transfer Type Press

By A. E. SWEET, Chief Tool Engineer
The Maytag Co., Newton, Iowa

TAPERED, tubular-shaped legs for the Maytag wringer type washing machines are formed from flat blanks on a completely automatic, six-station transfer type press seen in the heading illustration. On this 250-ton "Transmat" press, made by the Verson Allsteel Press Co., Chicago, Ill., developed blanks are automatically fed from a stack and carried from station to station until completely formed. Since the press operates at a speed of sixteen strokes per minute, production rates up to 960 per hour are possible.

With conventional methods of producing such parts, five presses of approximately 75 tons capacity, each with an individual operator, would be required to obtain less than half the present output from one transfer press. In addition to increasing production and lowering costs, material-handling from press to press is eliminated, floor space requirements are minimized, the

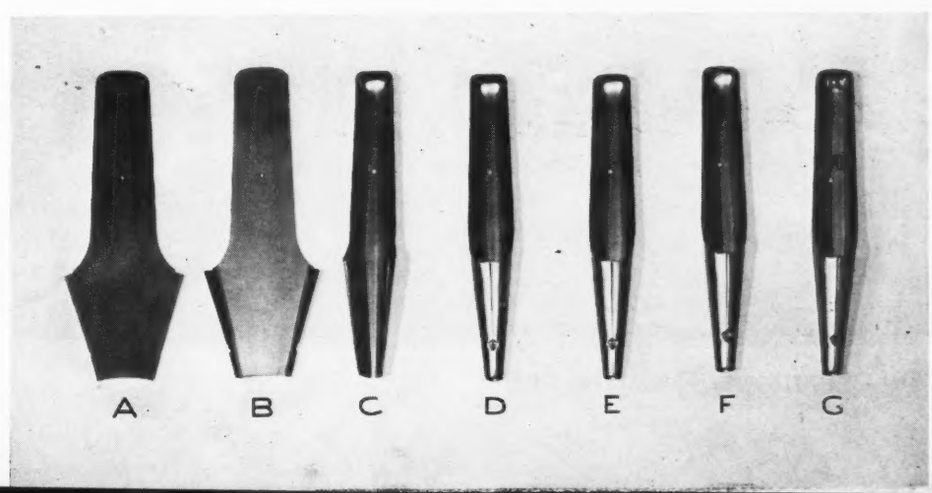


Fig. 1. Progressive shapes formed in the production of washing machine legs. Blank (A) is formed on one press, while shapes (B) through (F) are produced on a transfer press. The complete welded leg is shown at (G)

Fig. 2. Automatic stack feeding unit located at the loading end of the transfer press. Blanks p'aced on the tables are automatically transferred to the magazine and then grasped individually by transfer fingers

chance of human error in hand-feeding is removed, and machine maintenance is reduced. Although transfer type presses are not new, having been applied to many round and some rectangular, concentric-shaped products, this is believed to be the first application of this kind of equipment to such a non-concentric, complex-shaped part as a washing machine leg.

Developed blanks for the washing machine legs, like the one shown at *A* in Fig. 1, are produced on a separate Verson straight-sided press of 150 tons capacity. Commercial quality, hot-rolled sheet steel, 16 gage (0.0598 inch thick) by 36 inches wide, is purchased in coils each weighing approximately 7000 pounds. A Littell automatic coil feed and straightening unit are employed to pass the sheet through the blanking press at 8 3/4 inches per stroke. Although a 36-inch wide strip is not necessary, a considerable material saving is effected by nesting and producing two leg blanks and two leg ferrules (which are subsequently welded to the legs) with each stroke of the press. The press operates at forty strokes per minute, producing 4800 leg blanks and an equal number of ferrules per hour.

The developed leg blanks are placed on the two loading tables of an automatic stack feeding unit, located on the right-hand or loading side of the Transmat press, as shown in Fig. 2. Each table holds a stack of approximately seventy-seven blanks, and can be loaded while a third stack is being automatically fed from the magazine seen in the center of the unit.

The blanks are continuously fed from the mag-

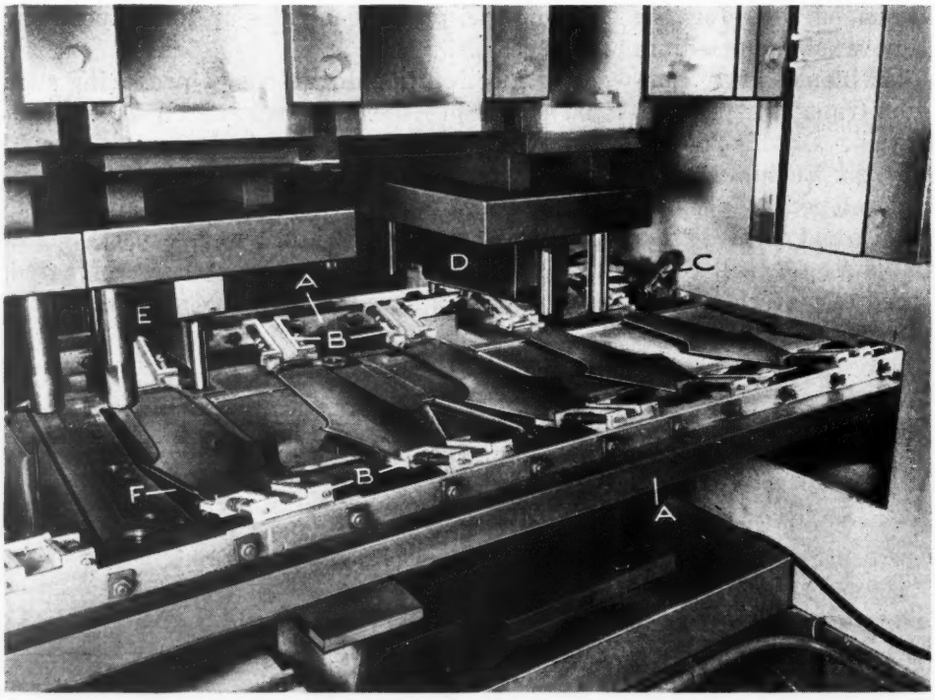
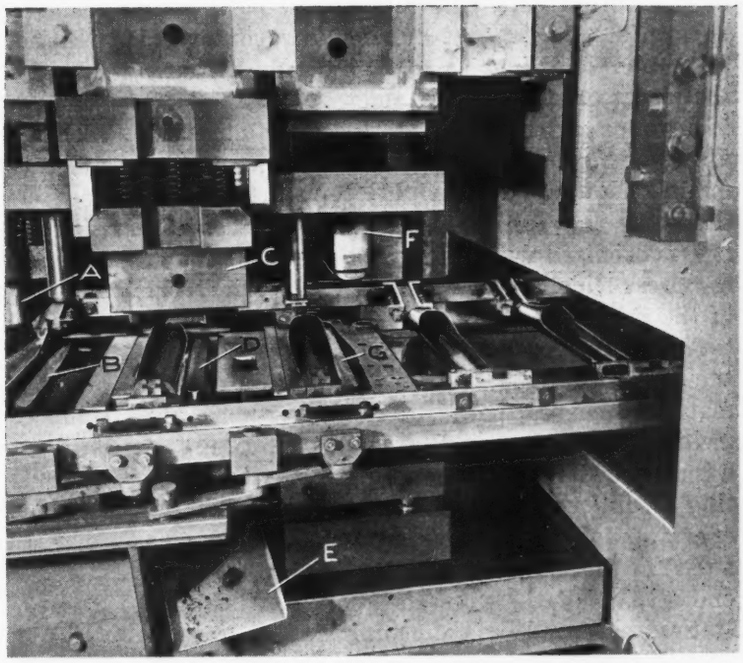


Fig. 3. Blanks entering the transfer press from the right are sprayed with drawing compound applied by an automatic, air-operated spray gun. The first three stations are shown in this illustration, forming and drawing operations being performed at Stations 1 and 3, while Station 2 is idle

Fig. 4. Rear view of the press, showing the fourth, fifth, and sixth stations, where the washing machine legs are successively closed, trimmed, and sized



azine into the press by means of two air-operated suction cups which lift each individual blank to the level of the transfer fingers. A blast of compressed air is directed on each side of the stack of blanks in the feeding magazine to insure that only one blank is picked up at a time. When the supply of blanks in the feeding magazine drops to a predetermined level, one of the two loading tables automatically swings into position under the magazine and the magazine is reloaded by means of an air-operated, vertical acting plunger.

Although coil stock could be fed directly to the transfer press by adding a blanking die at the first station, it has been found that more blanks can be obtained per ton of steel by nesting on wider coil stock and blanking in a separate press, as described.

The transfer press is of two-point construction, with eccentric type drive, pneumatic clutch and brake unit, and full electric controls. It is equipped with a single main slide, on which are mounted individual, independently adjustable slides for each die station. The main slide has a stroke of 12 inches, and the bolster area is 50 inches from front to back and 108 inches from right to left. Individual air cushions are provided for the first two dies, and spring-actuated pressure pads for two of the other dies.

A power take-off is provided for the automatic, mechanically actuated transfer mechanism which carries the parts from station to station. This mechanism consists of two channel-shaped aluminum pieces *A*, Fig. 3, which extend horizontally along both front and back of the press. Bolted to these pieces at regular intervals along their lengths are a number of sets of fingers *B*, which grasp the individual parts and advance them one station.

Both channel-shaped members

Fig. 5. Special projection type welding machine for joining attachment brackets and a caster-tube socket to the washing machine legs

move intermittently in a rectangular path (in a horizontal plane), first moving inward toward the center of the press so that the fingers grip the pieces as shown; next sidewise (to the left) to advance each part one station; then outward, after the fingers have released the pieces; and finally, sidewise (to the right) to return them to their original positions. This cycle of movements is synchronized with the up and down motion of the press slide, and is repeated with each stroke of the press.

As the blanks are carried into the press (at the right in Fig. 3), their top surfaces are automatically coated with drawing compound by means of a spray gun *C*. An equal mixture of a light paraffin-base oil and a sulphur-base cutting oil is employed. The first or pre-forming operation is performed with punch *D*, producing a part of the shape seen at *B* in Fig. 1. The second station of the press is idle. At the third station, a second or U-forming and a drawing operation are performed by means of punch *E* and die *F*, Fig. 3. This results in a part of the shape seen at *C* in Fig. 1.

Fig. 4 is a view from the rear of the transfer press, showing punch *A* and die *B* mounted at the fourth station for closing the tubular-shaped, lower portion of the washing machine legs. At the fifth station, punch *C* and cam-actuated trimming die *D* remove excess material from the top of the leg. It was found necessary to provide this small amount of extra material at the top of the developed blank in order to prevent wrinkling in the drawing operation performed at the third station. The scrap that was trimmed from the leg at the fifth station of the press is ejected on the chute shown at *E*, from which it slides into a tote box.

At the sixth and final station, punch *F* and die *G* size the legs and form the upper portion to match the contour of the washing machine skirt. The completed legs are 25 11/16 inches long and 4 inches wide near the center. As the unloading operator removes the legs from the press, he wipes the drawing compound from inside the upper portion of the legs, so that it will not interfere with a subsequent welding operation.

Three attachment brackets and a caster-tube socket are welded to the legs by means of special projection type welding machines, such as the one seen in Fig. 5, made by the Progressive Welder Co. The press type welder shown has one 100-KVA and two 75-KVA transformers and two air-actuated rams. One of the rams is equipped with two hydraulically operated welding dies which make welds between the brackets and the leg in a horizontal plane. The other ram completes a projection weld during its vertical stroke. The brackets are made from 13-gage (0.0897 inch thick) mild steel.

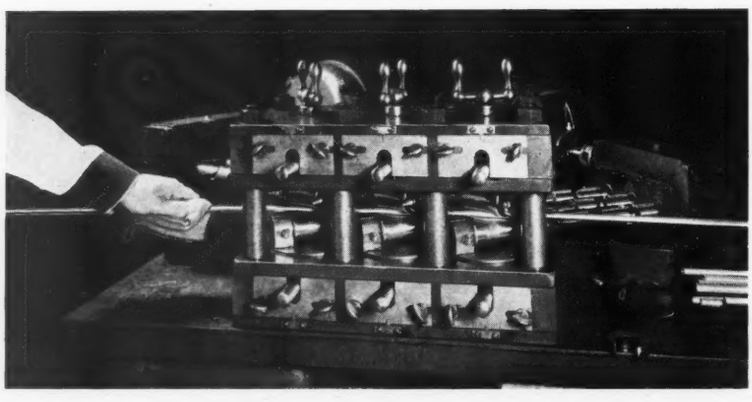
* * *

Straightening Non-Ferrous Tubing at Over 3000 Feet per Hour

Non-ferrous seamless tubing ranging in size from 7/32 to 1/2 inch in diameter is now being straightened at an average rate of 25,000 feet per eight-hour shift by means of a Mackintosh-Hemphill rotary straightener in the Philadelphia plant of the Precision Tube Co., Inc. The machine, however, has a rated capacity for handling 120 feet of tubing per minute.

The tubing is cold-drawn to size, and during the drawing operations, it takes a "set" or "bow" which can amount to as much as 3 or 4 inches in a 14-foot length. Straightening of the tube is essential to eliminate any whipping action in machining operations and to insure that one tube will fit satisfactorily inside another in certain applications, such as a telescopic car antenna. Straightness within a close tolerance is also required on tubing used by manufacturers of mechanical pens and pencils and ink cartridges for ball-point pens.

The rotary straightening machine bends the tube above the yield strength of the metal in order to overcome the set and to obtain permanent straightness. In the operation, the tubing passes between three sets of crossed rolls as illustrated. Individual lengths of tubing up to 45 feet are handled.



Mackintosh-Hemphill rotary straightener which takes the "bow" out of 25,000 feet of non-ferrous seamless tubing per eight-hour shift

The Industrial Press Announces Annual $1000 Award to Advertising Executives

THE Industrial Press, publisher of MACHINERY, announces the establishment of an annual Industrial Press Award, consisting of $1000 to be given to the industrial advertising man who, in the opinion of the judges, has made the best documented presentation to his management proving the need for a specific advertising program and showing how that program fills the need. The Award is given in cooperation with the National Industrial Advertisers Association. The competition is open to everyone actively engaged in advertising or marketing in the technical, trade, or industrial fields. Membership in the N.I.A.A. is not a requirement for eligibility.

The primary purpose of The Industrial Press Award is to encourage advertising executives to undertake more thorough groundwork and to prepare more effective presentations to management establishing the need for a specific advertising program. If such a need is definitely established, an advertising program designed to fill that need will have manifest value and appeal.

The publicity given to the Award and the announcement of the Award winning entry will have the further advantage of impressing many top company officers with the job that advertising can do. Also, summaries of the presentations can be used for distribution to salesmen to show them what the company advertising is setting out to accomplish and how it will benefit them by making their selling efforts more effective.

The Industrial Press Award is not concerned with the preparation or execution of the advertising campaign or with the results achieved, but rather with the groundwork that is done to establish the market pattern for a product and the documentation used to show how a specific advertising program fits the requirements of this market pattern. The presentation must, of course, give an outline of advertising objectives, but details of the campaign itself and subsequent results of the advertising should not be covered in the entry.

The Awards Administrative Committee of the National Industrial Advertisers Association will have complete authority with regard to annual judging procedure, and will select a panel of judges representing men from industrial top managements who are not directly connected with advertising.

Complete entry regulations and suggestions for those wishing to enter the competition may be obtained by writing to The Industrial Press, 148 Lafayette St., New York 13, N. Y.

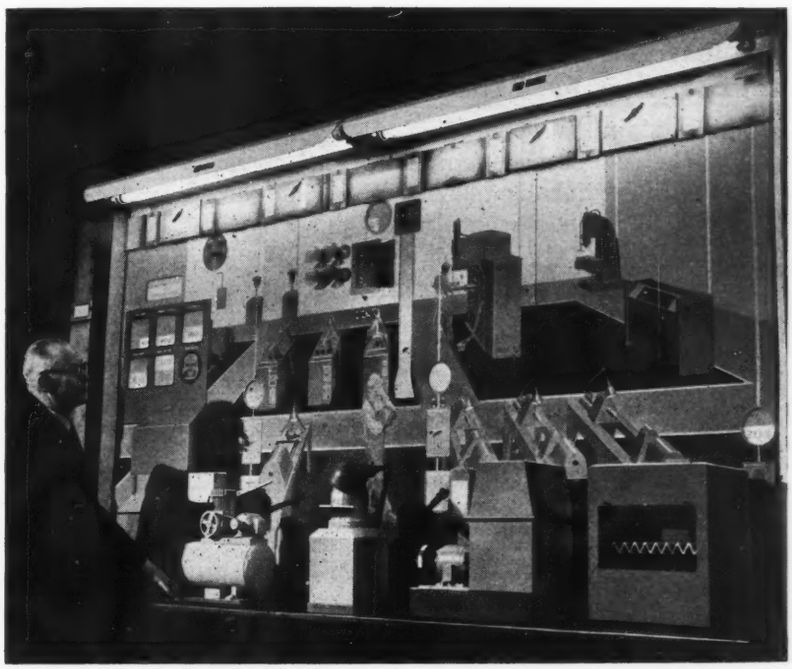


Exhibit board showing replica of a modern plant used by Westinghouse Electric Corporation to demonstrate how to analyze the needs of power distribution systems in industrial plants, so that the most efficient type can be installed. The "Planned Power Distribution" demonstration, which is to be exhibited throughout the country, shows bus-duct, capacitors, and circuit-breakers installed to replace an outmoded, three-phase, four-wire system. The comparative results obtained with both the old and new systems are clearly indicated by instrument readings that show the differences in lighting, heating, and power

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Coating that Resists Acids and Alkalies

The corrosive action of acids and other chemicals on railroad hopper cars and similar equipment is forestalled up to six times as long by a new finish having a Vinylite resin base. This coating, known as "Carclad," has been announced by the Bakelite Division of Union Carbide & Carbon Corporation, New York, N. Y. It provides long life and resistance to the corrosive effects of acids, soda ash, sulphur, alkalies, phosphate, common salt, and cement.

"Carclad" has the weather durability of the best grade synthetic enamels as well as unusual abrasion resistance. Concentrated acids affect the finish to some extent, but not so readily as they affect comparatively short-lived conventional finishes. Aromatic hydrocarbons, ketones, esters, and some chlorinated hydrocarbons will soften the finish, but as long as no abrasion occurs, the film will harden to its original state when allowed to dry. The same equipment and technique normally used for synthetic lacquer or enamel are employed in applying this coating. It is manufactured by the Sherwin-Williams Co., Cleveland, Ohio. 1

Stainless Steel with Same Coefficient of Expansion as Glass

A new stainless steel, USS 17-TV, makes possible the commercial manufacture of larger, lower-cost, more durable television picture tubes. Developed for video vacuum tubes, this alloy is being produced by the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.

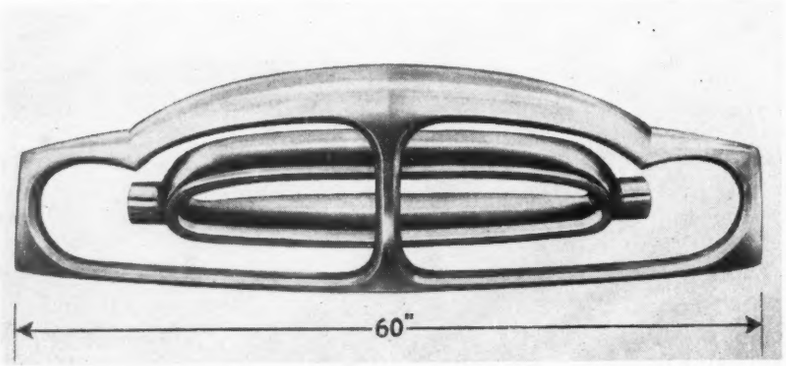
Glass and most metals sealed together expand and contract at different rates when heated and cooled, causing the glass to crack. The new stainless steel, whose rate of expansion and contraction parallels that of glass, is easy to form and strong enough to withstand the pressures caused by the vacuum inside the television tube.....2

Molybdenum Lubricant Obtainable in New Forms

The Lockrey Co., Lubricants Division, College Point, N. Y., has announced the development of several types of molybdenum-base lubricant.

"Liqui-Moly" is a molybdenum compound in liquid form which attaches itself by molecular attraction to metal bearing surfaces, forming a lubricating film which is not squeezed out by pressure and can withstand extremes of temperatures without affecting its lubricating qualities. The liquid evaporates, leaving a dry but lubricated bearing. "Liqui-Moly NV," in both regular and grease form, is incorporated in a liquid glycol derivative having a high viscosity, but which will pour at as low a temperature as minus 25 degrees F. These greases have a long life, chemical inertness, freedom from carbon and sludge, and do not dry out at elevated temperatures.

"Liqui-Moly NV" thread compound has the characteristic of preventing metals from seizing or "freezing" together under extreme pressure. This property makes it possible to disassemble



This new automobile grille is an example of the possible size of die-castings. It was designed by engineers of the Doehler - Jarvis Corporation in collaboration with the Packard Motor Car Co. Made of zinc, the grille measures 60 inches in width, and is believed to be the largest automobile grille in over-all area ever die-cast

To obtain additional information about materials described here, use Inquiry Card on page 225.

piping or equipment after any period of operation at high temperature or under severe corrosive conditions. Pipe and thread joints can be made up tighter with less torque or danger of damage, and disassembled with less pressure than the make-up requires.

"Moly-Wax-Stix" provides a convenient means of applying this molybdenum-base lubricant in solid form. Typical uses are for filling lubricant grooves in bushings or thrust washers, for lubricating glass pet-cocks and chemical glassware connections to prevent seizure, for rubbing on sliding ways to provide lubrication without oiliness, and for casting solid lubricant shapes....3

Rust Inhibiting Paint Can be Applied Over Corroded Surfaces

A new rust inhibiting oil-base paint for maintenance applications has been introduced on the market by United Laboratories, Inc., Cleveland, Ohio. Known as "Certified Rust Inhibitor No. 425," it serves as a rust preventive and finish coat in one application over damp as well as dry surfaces. This paint is resistant to fumes, salt air, and dry heat up to 500 degrees F., and can be applied to either new or rusted metal. 4

Brazing Alloy for Joining Stainless Steel and Nickel Alloys

"Nicrobraz," a heat- and corrosion-resistant alloy for brazing stainless steels, has been placed on the market by the Wall Colmonoy Corporation, Detroit, Mich. The joint of a stainless-steel assembly brazed with this alloy is said to possess the same strength at 2000 degrees F., plus better corrosion and oxidation resistance, as the parent metal. It can be used to braze Series 300 and 400 stainless steel, Inconel, Monel, alloy steels, tool steels, carbon steels, etc.

Assemblies to be brazed are prepared the same as for copper brazing, but with a joint clearance of not over 0.002 inch where highest quality joints are desired. Since stainless steels oxidize in regular brazing furnace atmospheres, brazing is best accomplished in pure dry hydrogen of minus 40 degrees F. dew point or below. The new brazing alloy is applied to the part and is held in place with Nicrobraz cement and will flow throughout a joint by capillary action when heated to 2050 degrees F. 5

Titanium and Titanium Alloys for High-Temperature Applications

The Remington Arms Co., Inc., Bridgeport, Conn., and the Crucible Steel Co. of America, New York, N. Y., have announced the formation of a jointly owned company, Rem-Cru Titanium, Inc., which will produce titanium metal and titanium-alloy products. Titanium and its alloys are expected to complement aluminum and stainless steel in new applications, since they combine the lightness of aluminum alloys with the strength and high-temperature usefulness of stainless steel.

Bars, sheets, plates, forgings, ingots, and billets in both commercially pure and alloyed titanium are now available, and other forms, such as strip, wire, and tubing will be made available as demand develops. The table below indicates some of the physical properties of titanium and its alloys at room temperature. 6

Properties of Rem-Cru Commercially Pure Titanium and Titanium Alloys at Average Room Temperature

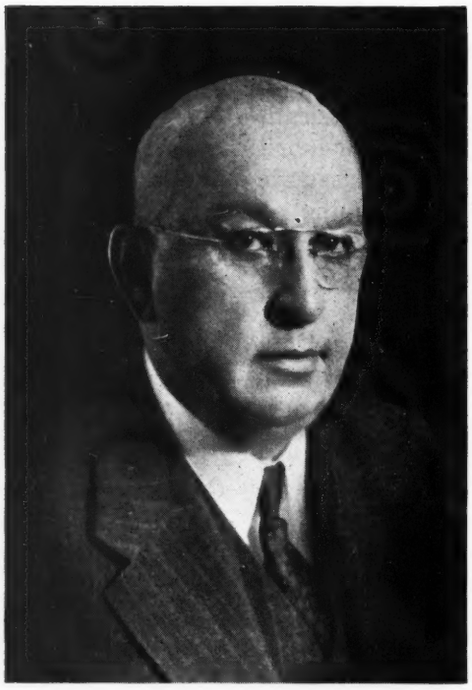
Property	Commercially Pure Titanium		Titanium-Base Alloys	
	RC-55[1]	RC-70[2]	RC-130-A[3]	RC-130-B[4-5]
Ultimate tensile strength, pounds per square inch	75,000	90,000	150,000	145,000
Tensile yield strength, pounds per square inch	65,000	80,000	140,000	135,000
Proportional limit, pounds per square inch	50,000	52,000	105,000	105,000[6]
Modulus of elasticity, pounds per square inch	15,500,000	15,500,000	15,500,000	15,500,000
Elongation, per cent	25	20	12–15	15–20
Bend radius, sheet	1.5–2.0T	2.0–2.5T	1.5–3.0T	.....
Creep strength at 0.0001 per cent per hour, pounds per square inch	.....	55,000	110,000	115,000[6]
Fatigue endurance limit, pounds per square inch	.....	50,000	75,000	80,000[6]
Impact strength, bar, foot-pounds	.....	15[5]	.....	13

[1]RC-55 is Rem-Cru commercially pure titanium with a 55,000 pounds per square inch minimum yield strength.
[2]RC-70 is Rem-Cru commercially pure titanium with a 70,000 pounds per square inch minimum yield strength.
[3]RC-130-A is Rem-Cru titanium-base sheet alloy with a 130,000 pounds per square inch minimum yield strength.
[4]RC-130-B is Rem-Cru titanium bar and forging alloy with a 130,000 pounds per square inch minimum yield strength.
[5]Forged bar properties; all other values listed in this table are sheet properties.
[6]Estimated from limited data.

To obtain additional information about materials described here, use Inquiry Card on page 225.

Edward K. Hammond

1885 — 1950



THE many friends of Edward K. Hammond throughout the machine tool and allied industries will regret to learn that he died suddenly from a coronary thrombosis at his home in Chicago on September 29. Mr. Hammond was well known in industrial circles because of his long service on the staff of MACHINERY. He was born in Morgan Park, Ill., in 1885. After graduating from the Armour Scientific Academy and Armour Institute of Technology with the degree of Bachelor of Science, he worked for two years in the shops of the Western Electric Co., and then became editor of *Modern Machinery*, formerly published in Chicago. Later he was in charge of a gas testing laboratory in the same city.

Ed Hammond joined the staff of MACHINERY on September 13, 1912, in the capacity of associate editor, and held that position until July, 1921, when he was made central western manager of advertising sales, with headquarters in Cleveland. During the years that he was on the editorial staff, Mr. Hammond wrote a prodigious number of articles that were unsurpassed for detail and accuracy.

In July, 1923, he was appointed western manager of advertising sales, with offices in Chicago, and served in that capacity until his retirement in April, 1948. Mr. Hammond worked hard and effectively, contributing largely to the up-building of MACHINERY'S prestige.

For many years, Mr. Hammond was a member of the Groundhogs (a Cincinnati club restricted to persons prominent in the machine tool industry); the Salmagundi Club of New York City; and the American Society of Mechanical Engineers. He is survived by his sister, Miss Violet Hammond of Chicago.

Technical Conference of A.I.E.E. Machine Tools Sub-Committee

ANNOUNCEMENT has been made by the Worcester Section of the American Institute of Electrical Engineers that a technical conference of the Machine Tools Sub-Committee of the A.I.E.E. Committee on General Industries Applications will be held at the Sheraton Hotel in Worcester, Mass., November 14 to 16, inclusive.

At the conference, various technical papers will be read and discussed dealing with electrical equipment as applied to machine tools. Among the papers scheduled are the following: "The Magnetic Amplifier—What It is and Where to Use It," by W. D. Cockrell, General Electric Co.; "How and Where to Apply Solenoids," by W. P. Patrick, General Electric Co.; "A Practical Approach to the Selection of Drive Equipment for Duty Cycle Applications," by Fred D. Snyder, Westinghouse Electric Corporation; "Principles and Problems of Dynamic Balancing," by W. I. Senger, Gisholt Machine Co.; "Flux Studies and New Controls for Magnetic Clutches and Brakes," by J. A. Mason, Warner Electric Brake & Clutch Co.; "Control Transformers," by J. M. Frank, Hevi Duty Electric Co.; "Machine Control Problems," by E. E. Opel, National Automatic Tool Co.; and "Considerations in Establishing High Frequency Ratings for Machine Tool Applications," by R. T. Fenn, Bryant Chucking Grinder Co.

One of the features of the conference will be plant inspection trips to various machine tool plants in the vicinity.

Constructing Arcs Tangent to Circles

By W. W. QUIST

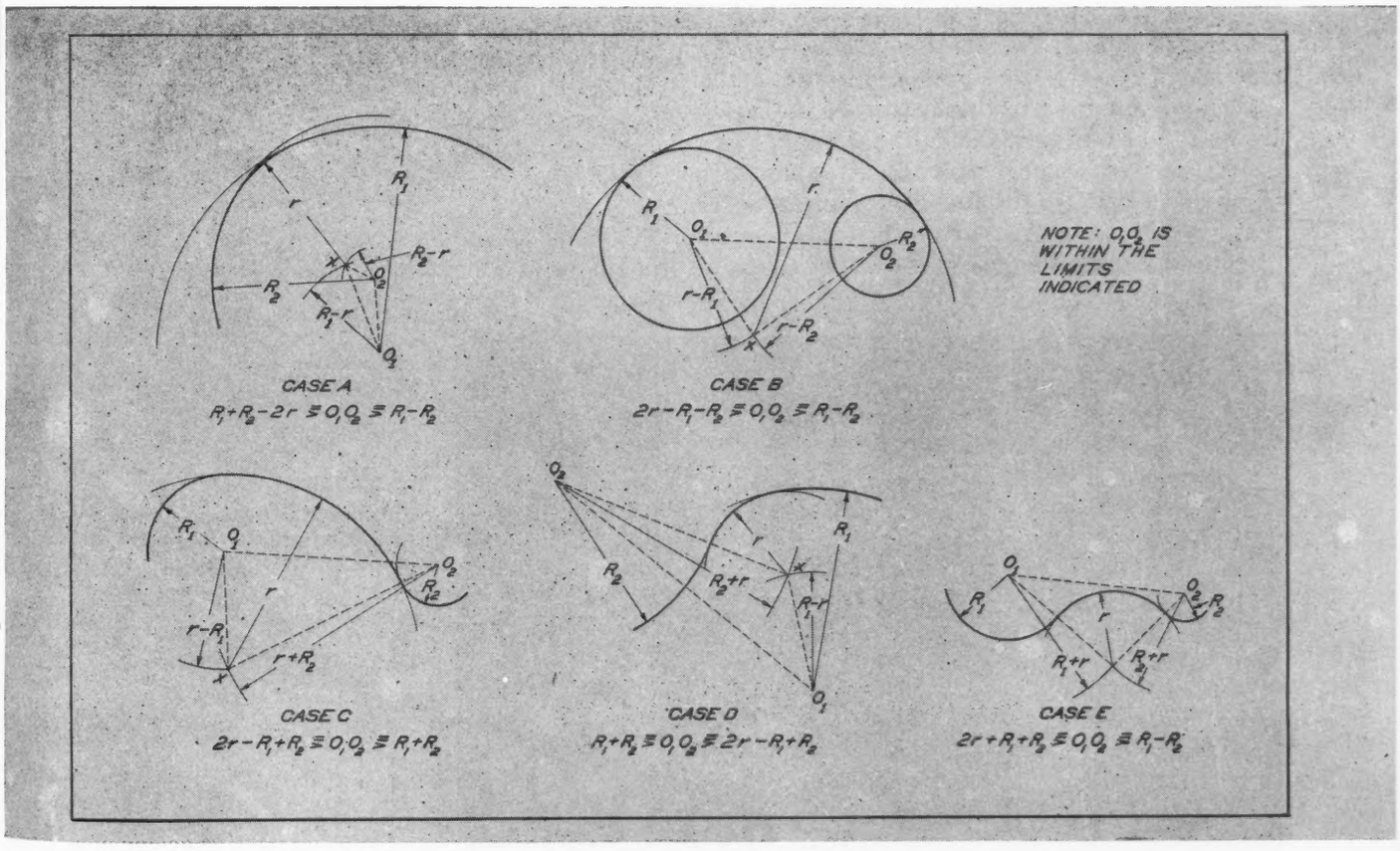
FREQUENTLY shop problems involve the construction of arcs tangent to two circles or to other arcs, as, for example, in laying out dies or in sheet-metal work. Trial-and-error methods of determining the center location of such an arc are often time-consuming and of doubtful accuracy.

The center location of the radius of the tangent arc can be quickly established by applying the geometrical proposition: When two circles are tangent to each other externally or internally, the line of centers passes through the point of tangency. The solutions to several typical problems for compound and reverse curves are given as examples of the use of this proposition in the accompanying illustration.

In each case, R_1 is the larger radius and R_2 the smaller radius of the given circles or arcs, and O_1 and O_2 are their respective centers. The given radius of an arc tangent to these two circles will be designated r, with the center x to be found. It will be noted that for this type of problem, where two arcs or circles are to be connected by a tangent arc, the centers of the given circles must be so located that the center distances O_1O_2 are within certain limits, as indicated in the illustration, so that the radii R_1—r, R_2—r, r—R_1, etc., will intersect. That is, distance O_1O_2 must be equal to or less than the sum of the intersecting radii and equal to or greater than the difference between them.

For the compound curve shown in case A, where r is less than either of the other two radii, x is located at the intersection of two arcs swung from O_1 and O_2, these arcs having radii equal to R_1—r and R_2—r, respectively. Reducing the terms of the intersecting radii, it can be seen that, in this case, the length of the center distance O_1O_2 must be equal to or less than the sum of the radii of the circles less twice the radius of the tangent arc ($R_1 + R_2 - 2r$) and equal to or greater than the difference between the radii of the circles (R_1—R_2).

Within these limits, $R_1 + R_2 - 2r$ and R_1 —



Typical problems in which it is required to locate the center of an arc tangent to two circles or other arcs

R_2, a center distance O_1O_2 will permit the intersection of the radii R_1—r and R_2—r, swung from centers O_1 and O_2, respectively, at a point x. The center of the tangent radius r is therefore located at x.

In the case illustrated at B, where r is greater than either of the other two radii, x is located at the intersection of two arcs having radii r—R_1 and r—R_2, swung from the centers O_1 and O_2, respectively. For this problem, distance O_1O_2 must be within the limits of $2r$—R_1—R_2 and R_1—R_2.

The centers of the tangent arcs x for the reverse curves at C and D are located in a similar manner. However, here the radius r of the tangent arc and the radii of the given circles are added for one intersecting radius and subtracted for the other. At C, the distance O_1O_2 will be within the limits $2r - R_1 + R_2$ and $R_1 + R_2$, while the relationship of the same limits to O_1O_2 are reversed in the case shown at D.

In the example shown at E, the center of the arc tangent to the two given circles is located by using intersecting radii $R_1 + r$ and $R_2 + r$, swung from centers O_1 and O_2, respectively. The distance between centers O_1 and O_2 in this case is limited by $2r + R_1 + R_2$ and $R_1 - R_2$.

* * *

During 1949 approximately 6,500,000 automobiles and trucks were produced in the United States—a new high in the history of the industry. It is estimated that in passenger cars, trucks, and replacement parts, 39,000,000 pounds of nickel in the form of alloy steels, irons, nickel plating, mill products, and other alloys were consumed during the year.

Castings Plus Welding Make a Better Design

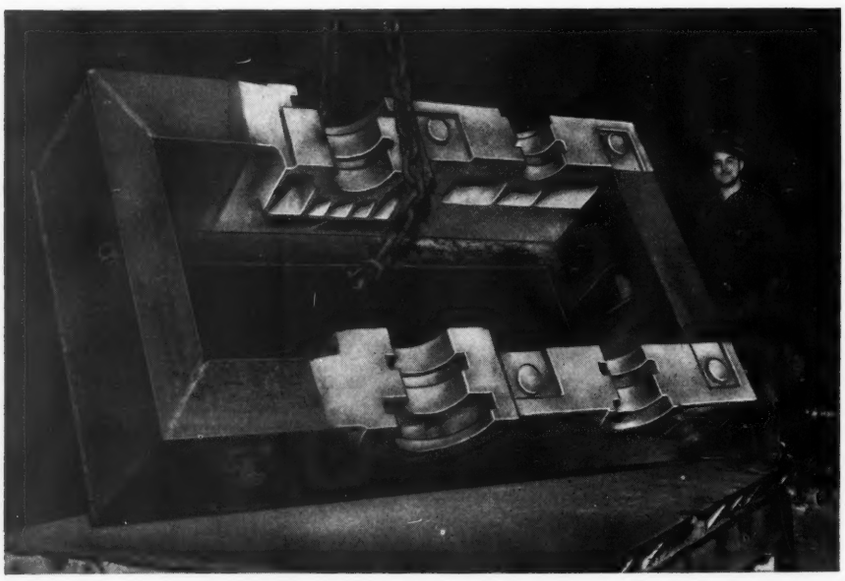
A prime consideration in designing a product is to plan for the best possible method of production from the standpoint of strength and rigidity. The use of steel castings and steel plate in a single machine element can be, in many cases, the most economical method of production to achieve the desired strength and rigidity. Steel castings and steel plate have the same modulus of elasticity and the same rigidity. A careful combination of the two materials can make for lower cost manufacturing.

In making gear drives and other heavy machinery at the Falk Corporation, Milwaukee, Wis., bearing-block supports are generally steel castings. The castings, however, are joined by welded steel plate. This combination of materials facilitates making a change in section if necessary, and it is cheaper to produce the supports by casting than it would be to duplicate the shape and details with welded steel plate.

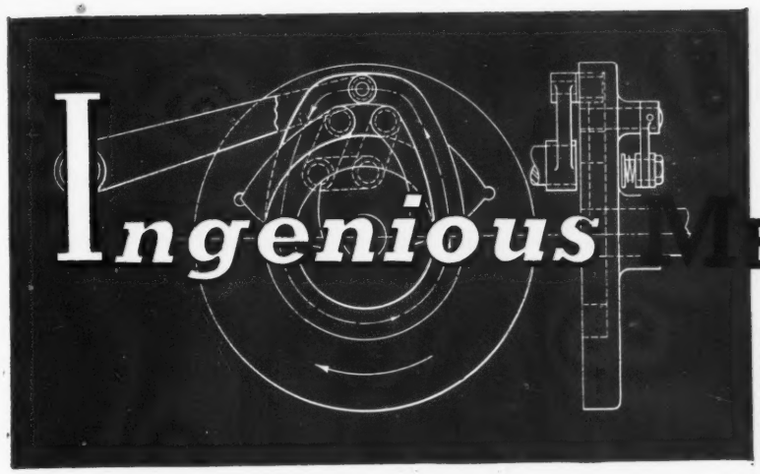
The accompanying illustration shows two large castings used for bearing-block supports in a 500-H.P. rolling mill gear unit, joined by welded steel plates. Large castings such as these are usually heated locally during welding, with gas torches, to minimize the tendency to crack. A lime-ferretic type of electrode, such as the Lincoln Electric Co.'s LH-70, is used on the first one or two passes of the welds to help minimize the tendency to crack and reduce the amount of local heating needed.

* * *

About 3500 tons of steel are said to be used annually in constructing movie "sets."



Rolling mill unit constructed of steel castings and welded steel plate



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

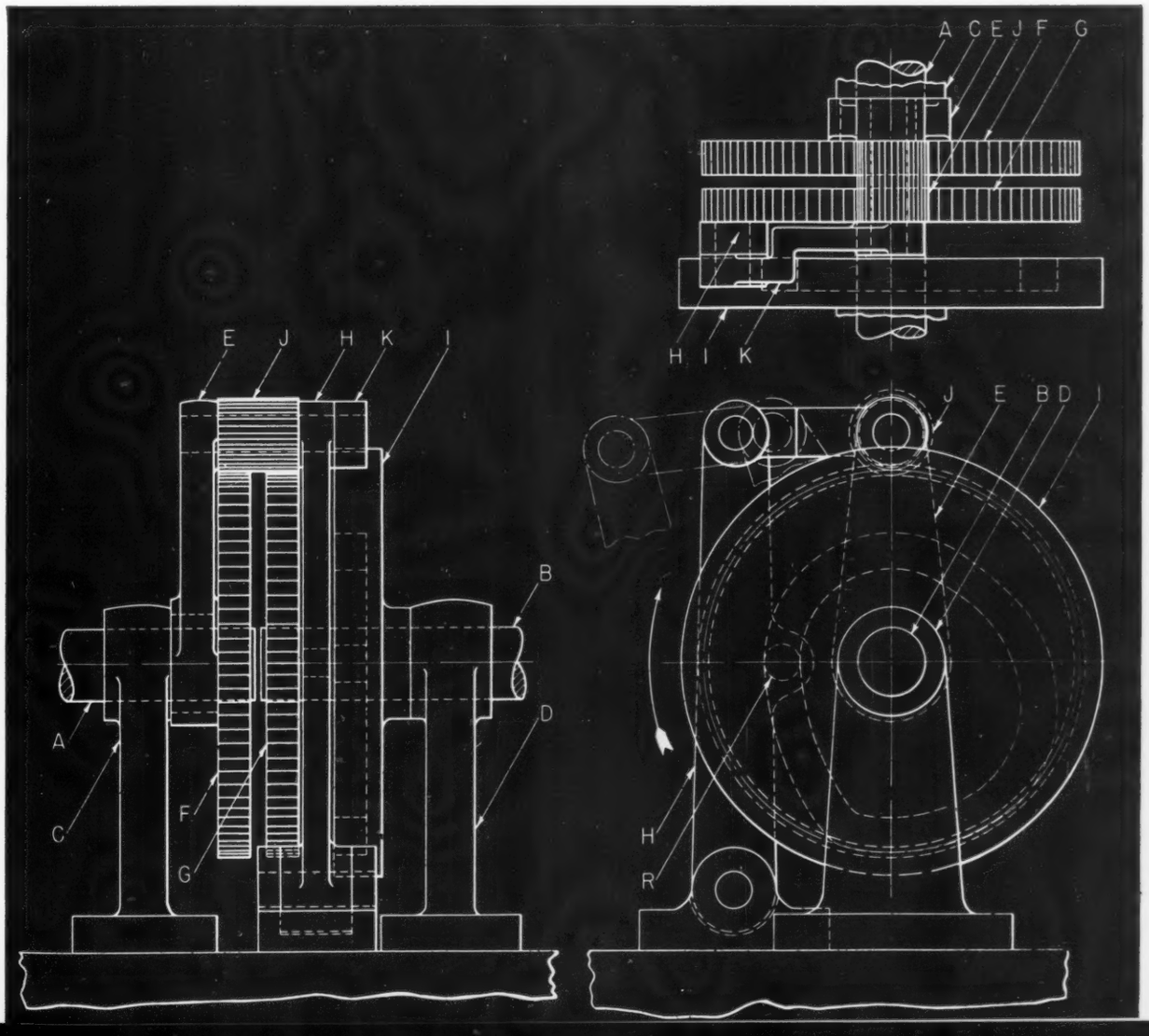
Mechanism that Produces Variable Speed from Constant Rotary Motion

By L. KASPER

On a wire fabricating machine, it was necessary to drive a shaft at a variable rate of speed through a definite cycle of motion. The only source of power was a shaft rotating at a constant speed in axial alignment with the driven shaft. A mechanism designed to meet this requirement is shown in the illustration.

Driving shaft *B*, supported by bearing bracket *D*, rotates in the direction shown by the arrow, and carries the gear *G* and the cam *I*, both of which are keyed to it. A gear *F* is keyed to the driven shaft *A*, which is supported by the bearing bracket *C*. The hub of bracket *C* is machined on the inner side to provide a bearing face for the bracket *E*, which is free to oscillate.

Cam and link mechanism that transmits variable speed from a shaft rotating at a constant speed



Bracket *E* carries at its upper end a stud supporting a pinion *J*, which is free to rotate as it meshes with gears *F* and *G*. The opposite end of the stud is connected by a link *K* to the upper end of lever *H* on which is mounted a cam follower *R* that engages cam *I*. The oscillation of lever *H*, produced through the action of cam *I*, is transmitted to bracket *E* by link *K*. Bracket *E* oscillates on the axis of shafts *A* and *B*, and gears *F* and *G* rotate on the same axis, pinion *J* always remaining in mesh with gears *F* and *G*.

As driving shaft *B* rotates in the direction indicated by the arrow, the action of cam *I* causes lever *H* to swing toward the left to the position shown by the phantom lines. The positions of bracket *E* and link *K* are also shown by phantom lines at this point in the cycle.

In order to clarify the resultant action, let it be assumed that no oscillating motion is transmitted to bracket *E*, in which case we have a simple gear train which transmits motion from shaft *B* to shaft *A* in the same direction and at the same speed of rotation. If bracket *E* were caused to rotate on its axis in the same direction and at the same speed as shaft *B*, no rotary motion would be transmitted to pinion *J*, which would then act as a pawl to rotate gear *F* in the same direction and at the same speed as gear *G*. However, when bracket *E* is caused to rotate in the same direction as shaft *B*, but at a higher or lower speed, or in the reverse direction, the rotative speed of shaft *A* will vary from that of shaft *B* during the time that bracket *E* is in motion.

Table Feed Mechanism Designed to Eliminate Manual Re-Engagement

On a special grinding machine, the work-table was driven by a screw geared to the power source. At the termination of the working cycle, a clutch dog was disengaged to permit the operator to return the table manually by means of a handwheel on the feed-screw. As the table movement was fairly slow, it was frequently impossible for the operator to engage the clutch immediately upon the completion of the loading cycle because the mating teeth were not in position for engagement. A period of several seconds was lost many times an hour in this way, making it advisable to change the feed mechanism to obtain an increase in production.

The design shown in the accompanying illustration provided the desired results. A drive-shaft *A*, which rotates in the direction indicated by the arrow and has a worm *C* mounted on it, is supported by two bearings *B* attached to a stationary part of the machine. Worm *C* meshes with a worm-gear *D*, which rotates freely on its supporting stud. The worm-gear also meshes with the screw *E* on the opposite side, screw *E* being supported by member *F* attached to the table *H*.

During the working cycle, shaft *A* transmits rotary motion to the worm-gear *D*, in the direction indicated by the arrows, through the worm *C*. This provides linear motion to table *H*, since screw *E* does not rotate, but acts as a rack. On completion of the working cycle, the screw *E* is rotated by handwheel *G*, in order to move table *H* in the opposite direction. While this is taking place, worm-gear *D* continues to rotate, but its teeth slide into and out of engagement with screw *E* without transmitting any rotary motion to the screw until the table is at the end of this travel, at which time it is loaded.

While being loaded, the table slowly moves toward the working position, as it is still connected with the drive-shaft through the worm-gearing. Should the loading cycle be completed before the table *H* has reached the working position, the handwheel *G* can be turned in a direction opposite to that in which it was turned previously to accelerate the table movement.

As none of the parts are disengaged at any time, there is no waiting period, resulting in a considerably shortened cycle. K. L.

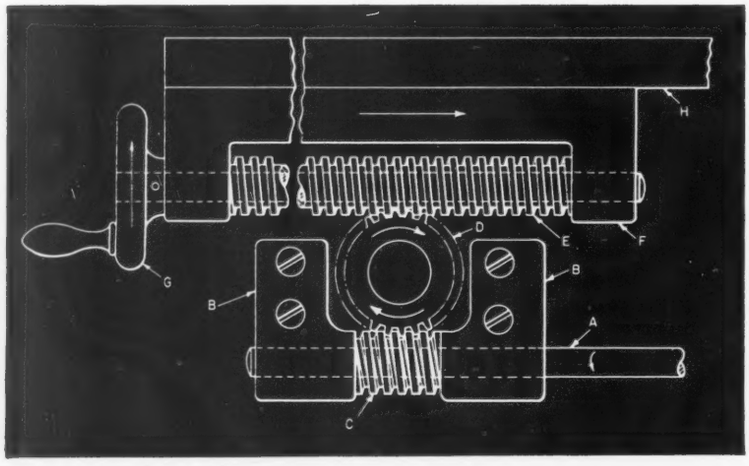


Table feed mechanism that eliminates manual re-engagement of the clutch and feed-screw

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Vise Adapter for Milling Slots in Two Parts at One Set-Up

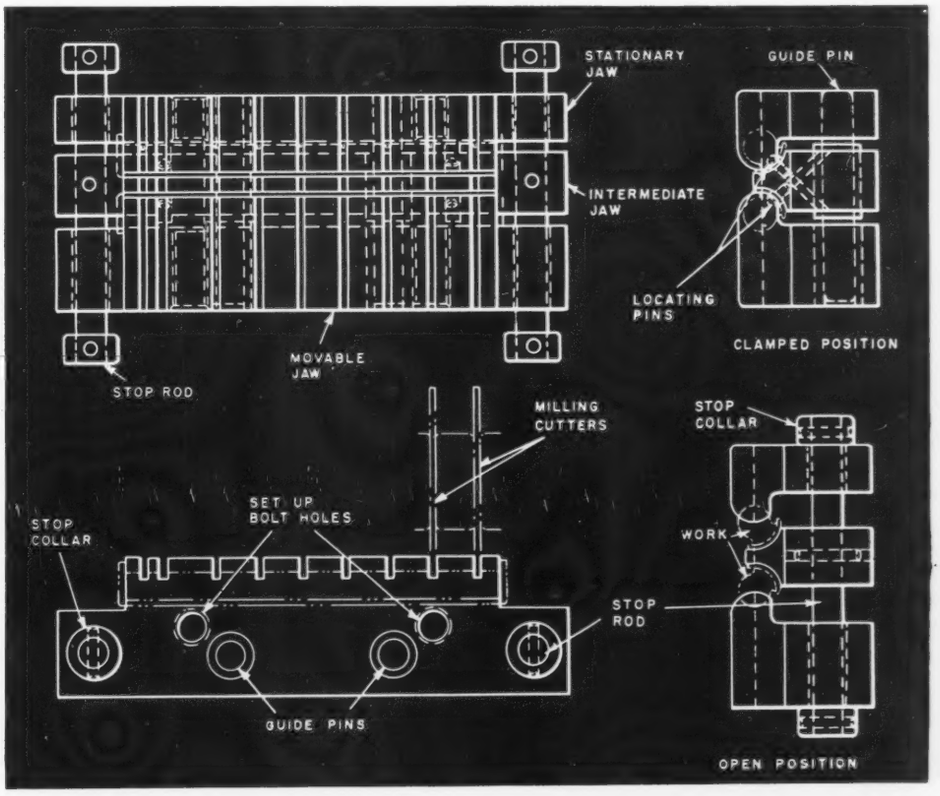
By A. C. EAGLE, Dayton, Ohio

Slots milled in both edges of the parts seen in the accompanying illustration must be at right angles and accurately aligned with each other. This is accomplished in one set-up by means of the two-station vise adapter shown. One part is clamped between the stationary jaw and the sliding intermediate jaw of the adapter, while another is held between the intermediate jaw and the movable jaw.

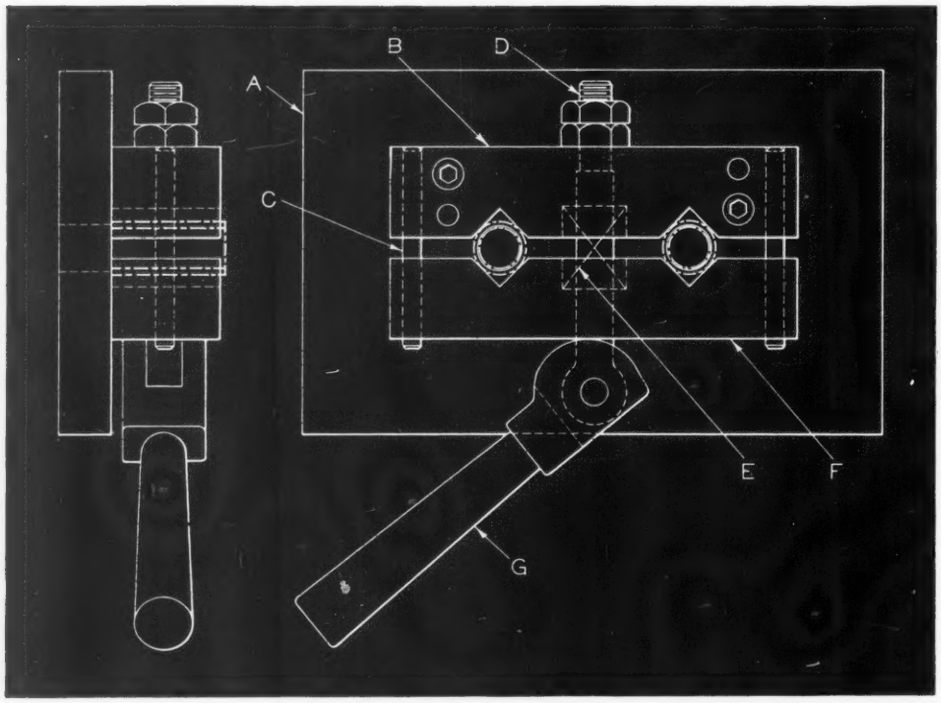
Each part is accurately positioned by two locating pins, pressed into the intermediate jaw, which enter reamed holes in the part. After the milling cutters have been fed across the work to produce the slots in one edge of each part, the parts are interchanged and another pass of the cutters is made, thus completing both parts.

The adapter fits a standard milling machine vise, the stationary jaw of the adapter being bolted to the fixed side of the vise, while the movable jaw is secured to the sliding portion. Stationary, intermediate, and movable jaws of the adapter are held in alignment by two guide pins, which are a press fit in the stationary jaw and a sliding fit in bushings in the intermediate and movable jaws. Holes in each end of the movable and stationary jaws provide clearance for the two stop-rods, which are pinned to the intermediate jaw. Collars are pinned to both ends of each stop-rod.

As the vise is opened, the movable jaw is drawn away from the intermediate and stationary jaws. When the outer edge of the movable jaw comes into contact with the collars on one end of the stop-rods, the intermediate jaw also begins to slide on the guide pins, away from the stationary jaw, since it is pinned to the stop-rods. Movement of both jaws is stopped when



Two parts are clamped in this vise adapter for milling slots in one edge of each part. The parts are then interchanged to mill slots in the other edges



Small size bushings can be clamped securely and quickly in this simple fixture for performing drilling and reaming operation

the collars on the opposite end of the stop-rods strike the rear edge of the stationary jaw. The adapter is then in the open, or loading, position, as shown in the partial end view at the lower right.

When the parts have been positioned on the locating pins, the vise is closed. The movable jaw first clamps one part against the intermediate jaw, and then slides this jaw along the guide pins until the second part is clamped against the stationary jaw. A partial end view of the clamped position of the adapter is shown at the upper right.

Quick-Acting Fixture for Holding Small Bushings

By IRVING MANSFIELD

The fixture shown in the accompanying illustration was designed to hold small bushings while reaming, tapping, and chamfering. It is fast acting, easy to operate, and can be used for a wide variety of parts.

It will be seen that the principal parts of the fixture consist of a base *A*, a stationary V-block *B*, and a sliding V-block *F*. The base is made of cold-rolled steel. To the top of the base, the V-block *B* is screwed and doweled. A hole is drilled and counterbored in the center of blocks *B* and *F* to receive a stud *D* and a spring *E*. The sliding V-block is made of hardened steel. Two holes are reamed in each end of the V-blocks to receive dowel-pins *C* which serve as guide pins for V-block *F*. Two clearance holes are drilled in the base directly under the work to provide for the escape of chips.

In use, the operator places a bushing in each vee and exerts clamping pressure by moving cam-lever *G*. To unload the fixture, cam-lever *G* is moved in the opposite direction to release the clamping pressure, and spring *E* forces V-block *F* away from the work. When the clamping pressure needs to be altered or a different diameter bushing is to be handled, it is an easy matter to loosen the check-nuts on stud *D* and adjust them as desired. If greater gripping power is needed, the vees can be serrated.

Welded Construction Simplifies Jig for Drilling Irregular-Shaped Casting

By ROBERT MAWSON, Providence, R. I.

A jig of welded construction was designed for drilling a 1 19/32-inch hole in a boss in the irregular-shaped cast-iron part indicated by dot-and-dash lines in the illustration on page 191. This jig is much lighter than one made with a cast-iron base, and yet is equally strong. Means are provided for rapidly locating and clamping the work, as will be described in the following.

Before machining the 1 19/32-inch hole in the work, the large flange and the upper boss of the part were faced; the two center holes were bored; and two 1/2-inch holes were drilled and

reamed in the flange. The machined surfaces of the work were used in locating and clamping the work in the jig.

The method of constructing the jig was as follows: Parts *A*, *B*, *C*, *D*, *E*, *F*, *G*, and *H* were made of machine steel and welded together to form the jig body. A cyanided cold-rolled steel shaft *J* was threaded to engage tapped holes in members *E* and *F* and held in place by a nut. The outer end of the shaft was reduced in diameter and threaded for a lock-nut. An open-sided knurled-edge washer *K* was placed on this end of the shaft to hold the work in position.

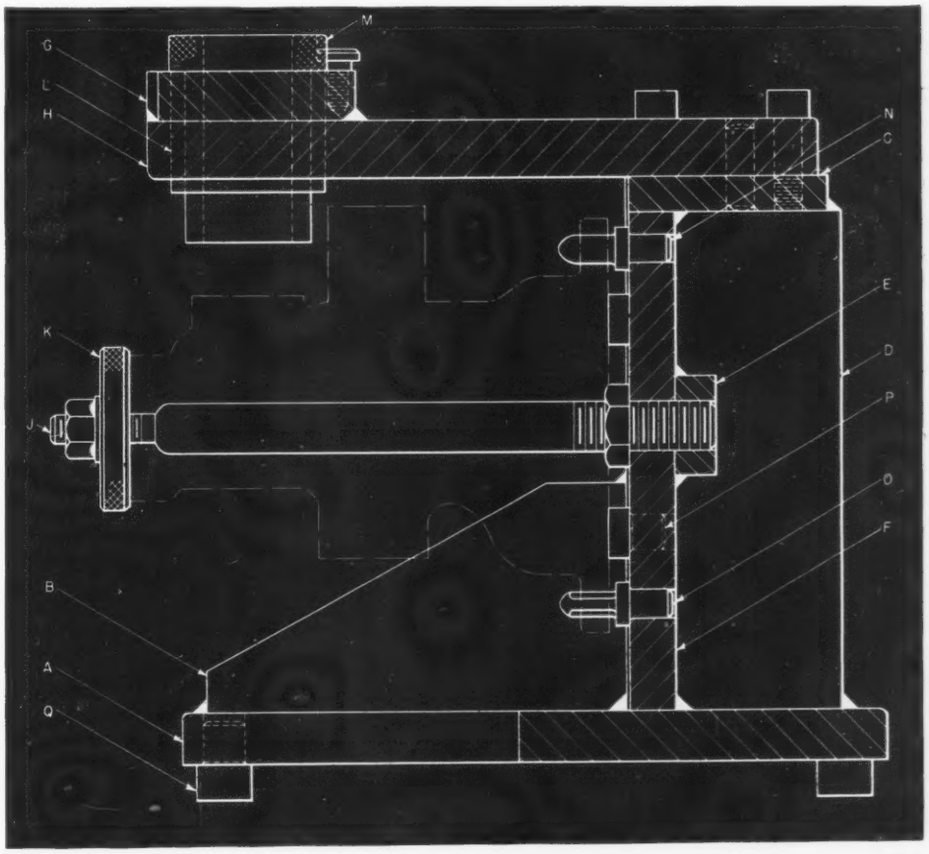
In an accurately located bored hole in parts *G* and *H*, a hardened and ground tool-steel liner bushing *L* was placed to provide a good sliding fit for two hardened and ground tool-steel guide bushings. One of these bushings is for a 1 1/4-inch drill, and the other for a 1 19/32-inch drill. Lock-screw *M* was provided to keep the bushings from rotating while the machining operations are being performed.

Two holes were accurately reamed in member *F* to a drive fit for locating pins *N* and *O*. These pins were made from hardened and ground steel and constructed with bullet noses to facilitate placing the work in the jig. Pin *O* was also machined with 30-degree angular surfaces for greater ease in loading.

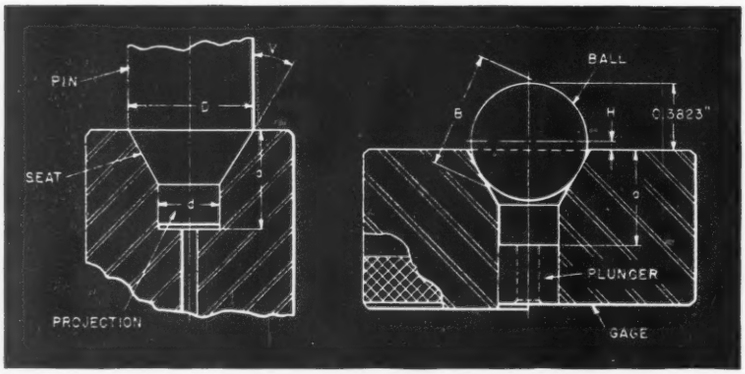
Four other holes were reamed in part *F* to receive hardened and ground tool-steel work-piece rest-pins *P*. The outer surfaces of these pins were ground to provide a true surface for the face of the flange of the work-piece. Hardened tool-steel buttons *Q* were inserted in the base of the jig and the bottom surface was ground parallel with the upper face of part *G* and also at right angles to the outside face of pins *P*.

To load the jig, the nut at the outer end of shaft *J* is loosened and open-side washer *K* removed, after which the nut is screwed back for a short distance. One of the work-pieces to be drilled is then placed over the shaft *J* and located in the jig by fitting two of its 1/2-inch reamed holes over pins *N* and *O*. Washer *K* is next replaced on the shaft, and by tightening the nut against the outer face of the washer, the work-piece is held securely in position for the machining operation.

The guide bushing with the 1 1/4-inch hole is now placed in liner bushing *L* and a hole drilled in the work-piece. This slip bushing is then removed and the other guide bushing inserted for enlarging the drilled hole to 1 19/32 inches. In order to remove the drilled work-piece, it is only necessary to loosen the nut and take off the open-sided washer. Thus it will be seen that the jig can be loaded and unloaded with a minimum of lost, or unproductive, time.



Welded drill jig permits quick locating and clamping of irregular casting for drilling operations



Flush-pin gage for accurately grinding combination drills to produce conical seats and pilot recesses to a precise depth

Gage that Insures Accurate Grinding of Combination Drill

By WALTER GABRIEL, Omaha, Neb.

Combination drills of the sub-land type were used in producing cone-shaped seats for rotating pins. In addition to the conical ends, the pins had a straight pilot, as shown at the left in the illustration. Although the seats had a straight recess into which the pilot entered, it was important for the pins to bear on the conical surface rather than at the end of the pilot.

Because of the large quantities to be produced, it was impractical to drill the straight portion of the seats deeper than was absolutely necessary to clear the pilots. To insure obtaining the proper depth, the drills were ground precisely to size by the use of the flush-pin gage shown at the right.

After resharpening or grinding, the drills are placed in the gage so that the tapered section seats in the cone, with the straight end in contact with the gage plunger. The movement of this plunger relative to the step on the gage shows whether or not the straight section of the drill is of the proper length within the specified tolerance.

In making the gage, the body is machined, knurled, hardened, and ground internally. Stock is left for surface grinding the top, so that the required diameter at the top of the conical seat can be obtained easily. This is accomplished by selecting a ball having a diameter B large enough to permit it to be seated a little less than half way in the cone. By measuring from the top surface of the gage over the top of the ball and subtracting the ball radius, dimension H (the distance the center of the ball is above the surface) can be determined.

This figure can then be used to calculate the amount of stock that should be removed from the top of the gage to obtain a given diameter D at the top of the conical section by using the following formula:

$$H = \left(\frac{B}{2} \operatorname{cosec} v\right) - \left(\frac{D}{2} \cot v\right)$$

where $\frac{B}{2}$ is 0.343 for a ball 0.687 inch in diameter, v is 30 degrees, and diameter D is 0.750 inch, we get

$H = (0.343 \times 2.0) - (0.375 \times 1.732)$

$H = 0.0385$ inch

Adding the ball radius to this value of dimension H, the height over the ball should be $0.0385 + 0.343 = 0.3815$ inch when the opening at the top of the conical section is 0.750 inch. The measured reading will be less than this figure due to the fact that stock was left for grinding; therefore the amount of stock to be removed will be equal to the difference between 0.3823 inch and the actual reading.

To finish the gage to dimension a, the depth of the conical seat is calculated, and to this dimension is added the length of the pin projection and the clearance between the end of the projection and the recess. The length of the plunger is made equal to the difference between dimension a and the over-all length of the gage less the tolerance allowed for the length of the straight portion of the drill.

* * *

American Standard Gear Nomenclature

An American Standard Gear Nomenclature, Terms, Definitions, and Illustrations, B6.10-1950, has just been approved by the American Standards Association, 70 E. 45th St., New York 17, N. Y. To help bring about the use of uniform terminology in offices, shops, and text-books, this standard was prepared by a committee representing manufacturers, users, and independent experts. It provides a system of terms and their meanings grouped as a logical series rather than in alphabetical order. It also includes illustrative figures. Copies are available from the Association at $1.50 each.

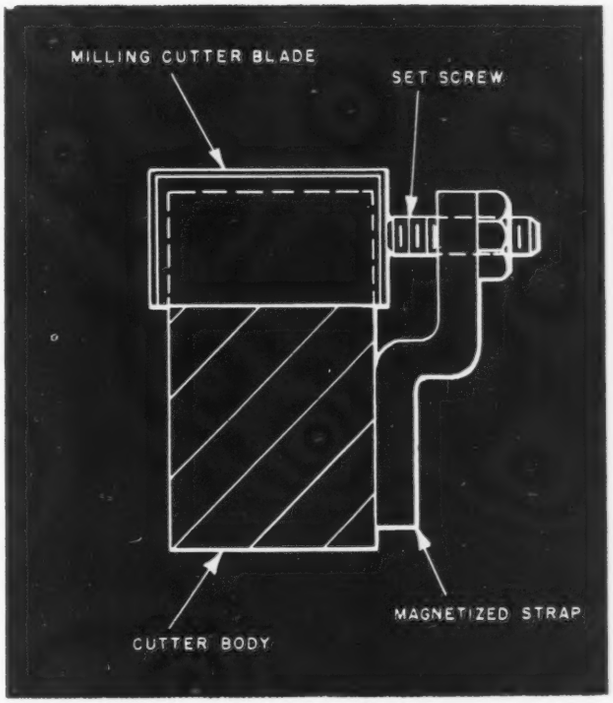
Ideas for Shop and Drafting-Room

Gage for Setting Inserted Blades of Milling Cutters to Proper Depth

By IRVING MANSFIELD

Setting inserted blades of face milling cutters to the proper depth can be speeded up by the use of a simply constructed gage such as shown in the accompanying illustration. A piece of cold-rolled steel, approximately 1/4 inch thick by 3/4 inch wide, is bent to the shape of a strap as shown, and a hole is tapped through one end to receive a standard headless set-screw. The strap can then be magnetized by simply laying it on a magnetic chuck.

To use the gage, the set-screw is adjusted so that the blades, when brought in contact with it, will be set to the desired depth. The gage is then laid against one face of the cutter body, after which each blade is set against the screw and clamped in place.



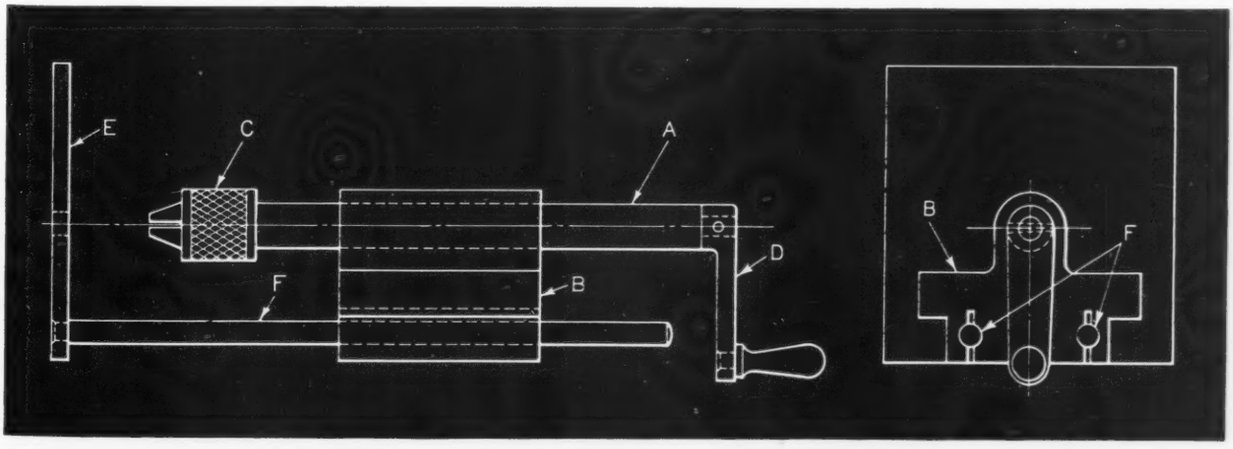
Simple gage, constructed from a magnetized steel strap and set-screw, which facilitates setting the inserted blades of face milling cutters to the proper depth

Fixture that Insures Accurate Alignment in Hand Tapping Operations

By JOHN HOMEWOOD, Ontario, Calif.

A simple hand tapping fixture, designed for use in a vise, is shown in the accompanying illustration. The fixture insures accurate alignment of the tap relative to the work. Spindle *A*, which is free to slide in bearing block *B*, is provided with a small chuck *C* to held the tap and a hand-lever *D* that is rotated to advance or retract the tap.

The part to be tapped is clamped to the face of plate *E*, which is provided with a clearance hole for the tap. Holes are also provided in plate *E* to receive the ends of guide pins *F*. The guide pins are held in slots machined in the underside of block *B*, which provide a clamping action on the pins. The distance between block *B* and plate *E* can be varied to suit the thickness of the work being tapped.



Arrangement that insures accurate alignment between tap and work during hand tapping operations. The work is clamped to plate (E) and the tap is held in chuck (C)

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Calculating Shaving Diameters of Pinions

M.E.S.—In the June issue of MACHINERY, W. H. Bookmiller gives an example of the calculation of maximum and minimum shaving diameters of pinions. To start with, he assumes the dimension h to be — 0.071807 inch. On what basis is dimension h assumed to be known, and if it is selected at random, what guide is used for such a selection?

Answered by W. H. Bookmiller

The dimension h represents the distance from the hob pitch line to the point on the hob protuberance that produces the maximum undercutting of the gear tooth in the root portion. It is measured perpendicularly relative to the hob pitch line. This point on the hob tooth is commonly known as the high point of the protuberance, and calculation or measurement of the dimension h is readily accomplished by one of the following methods:

1. If a drawing of the hob is available, the dimensions given for the hob can be used to calculate h. The accompanying diagram shows how this can be done.

2. If a drawing of the hob is not available, the location of the high point may be determined by inspection. This inspection is done mechanically on a surface plate, using gage-blocks and indicators, or by the use of inspection equipment capable of making a profile check of the hob cutting edge. Care must be exercised in checking the hob to obtain measurements from the hob pitch line and perpendicular to the pitch line. In the case of long- and short-addendum gears, the difference in hob addendum must be considered.

3. If the hob can be mounted on an optical comparator, so that the gash of the hob is perpendicular to the light beam, the height to the high point of the hob can be measured on the screen. The comparator screen, in this case, would have to be large enough to show most of the hob tooth.

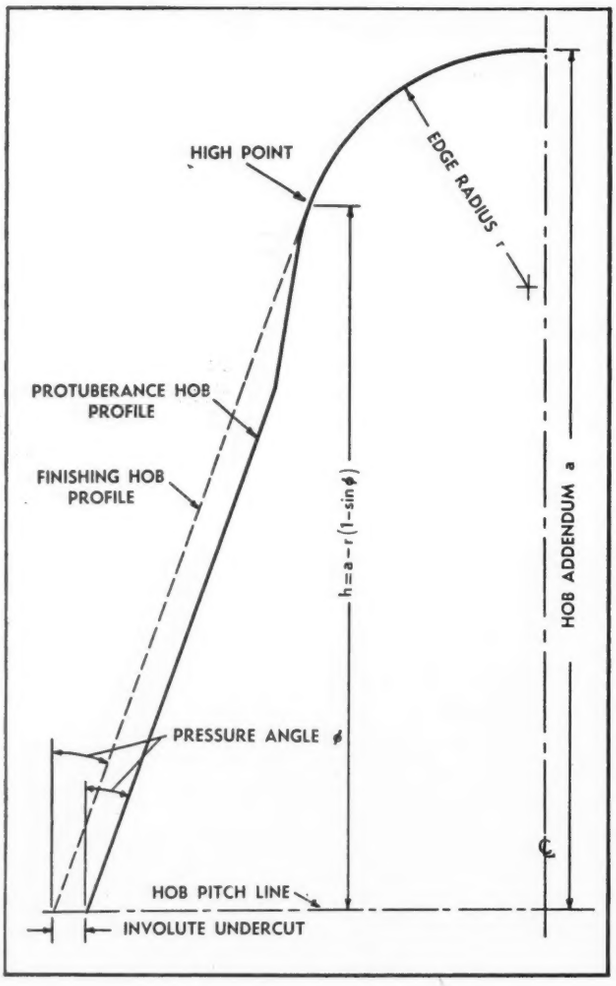


Diagram used in calculating the distance (h) from the hob pitch line to the high point of protuberance

* * *

The United States will use more synthetic than natural rubber during the remainder of this year and throughout the year 1951, according to the United States Rubber Co. Synthetic rubber will account for about 54 per cent of the country's total consumption in the last four months of this year, and considerably more in 1951. In the first eight months of this year it was 40 per cent. The reason for the increasing use of the synthetic product is that the Government is buying large tonnages of natural rubber for stockpiles to insure our security in the event that supplies should be cut off. The swing from natural to synthetic rubber will not produce the technical headaches that kept research and production men awake nights in World War II. Plants now have a rich store of knowledge and the necessary equipment to make the change quickly.

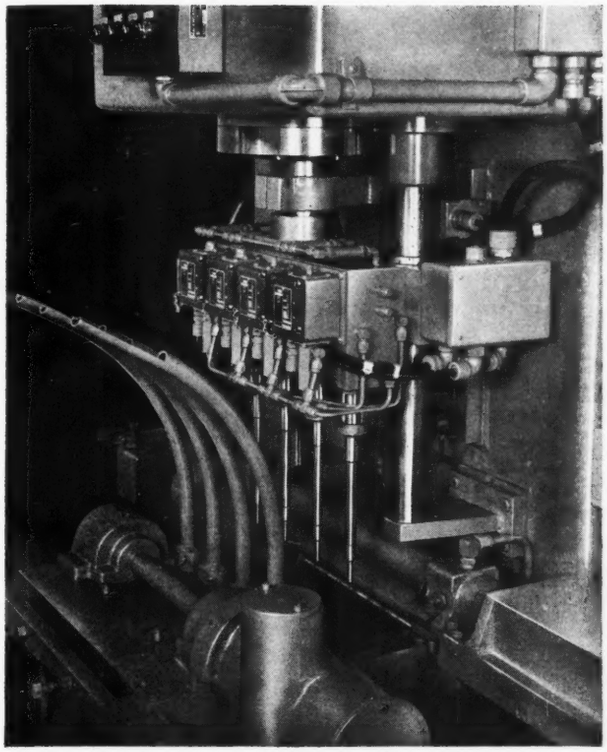


Fig. 1. Close-up view of Colonial press designed for assembling four valve guides into automobile cylinder heads simultaneously

Pressing Four Automatic Valve Guides into Place Simultaneously

One of the outstanding machines in a new cylinder-head production line set up for the Willys-Overland Hurricane F-head engines is a completely automatic 15-ton press, which assembles valve guides into place four at a time. A close-up view of this machine is illustrated in Fig. 1, while in Fig. 2 are shown the lower side of a casting without the guides (at the left) and the upper side of a casting with the guides in place (at the right).

The automatic cycle of the three-station machine, which was designed and built for this operation by the Colonial Broach Co., Detroit, Mich., consists of the following six steps:

1. The cylinder head is loaded at Station 1 between guide rails, and backed against a stop.
2. The head is transferred to Station 2, where it is located automatically.
3. Brushes move up from below to clean out the valve-guide holes in the casting and leave an oil film to lubricate the guides as they are pressed into place.
4. A shuttle feeds four valve guides from a tube-loaded hopper and moves them out over the top of the cylinder head directly under the assembling plungers of the machine.
5. As the ram moves downward, the four stepped plungers enter the bores of the guides and press them into the casting.
6. The ram moves back to the top position, the shuttle returns to the hopper for four more guides, and the next cylinder head is automatically moved into position, which pushes the finished head on to Station 3, from where it is ejected on a conveyor.

Automatic inspection is also provided by the machine, since it is equipped with pressure switches which interrupt the cycle if any one of the four press fits is either too tight or too loose. Signal lights at the top of the machine indicate the trouble and show directly which guide is defective, enabling the machine operator to remedy the trouble with minimum "down" time. In addition to improved quality control, the inspection system also prevents damage to the machine or to the head castings.

* * *

In the fifty years since 1900, when 4192 passenger cars were produced, the United States has built more than 108,000,000 motor vehicles.

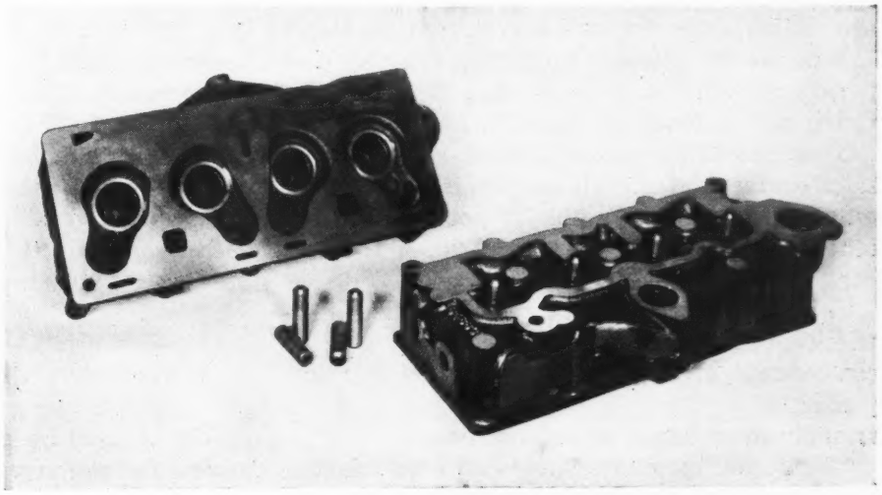


Fig. 2. Under side of cylinder head without the valve guides in place (at left) and upper side of head with the guides in place (at right)

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

Importance of Making Friends with Other Sales Engineers

NEXT in importance to our friendship with those people who have a say in buying is friendship with other non-competitive sales engineers.

Two sales engineers in Pittsburgh became close friends. One sold pumps and compressors, and the other electrical equipment. Each traveled far south into West Virginia, making periodic visits to coal mines and industrial plants, which used products offered by both men. Not often did these journeys coincide. Each met owners, purchasing agents, and operating men. Each had his following.

Since these sales engineers were not competitors, what was more natural than a close working relation between them? They often acted as scouts for each other—a source of information—within the limits, of course, of good business ethics. Each learned from the other such points as the following:

What are the latest business developments and trends in the various trading areas?

What new operations or plant developments are getting under way and how urgent are they?

Who are the key men in a given prospect corporation? What are their likes, dislikes, attitudes, and methods of operation?

This friendship was a profitable one to both sales engineers, for each was a stimulant to the other. Often one was able to point out to the other the necessity of a hurried trip, or the wisdom of delaying one proposed.

Every sales engineer's stock in trade is skill—wisely applied—and time. These two precious components of success were economically implemented in the case cited, simply through a friendly interchange of information.

"But," you may say, "how can I be friendly with just one engineer selling materials-handling equipment, pumps, compressors, power equipment, motors and controls, or small tools? Why limit our friendships?" There is no need to do this. The more friends we have, the better; we learn something from each one. Though many of these friendships may compete with one another, the first lesson we must learn is not to betray confidence, and the second lesson is that "to get we must also give."

Recently a young sales engineer came to me for suggestions on how he could break into a "cold prospect" for a large assembly of his equipment. When I had given him what advice I could, he remarked: "I've found out in making my sales plans that one of my best sources of information is frequently other friendly sales engineers who are selling to the same concern." He was using his head.

Many of us don't fully appreciate, or even remember, that our machines or tools are commonly useful only as part of a process that includes much more than those items we offer. Concentration on our particular tool, and our keenness to sell it, may temporarily blind us to the broader picture.

Consider, for instance, each prospect we have as a dot in the middle of a page. As one salesman, we try to influence his opinions and reach a decision favorable to us. We are then only one arrow directing our sales effort on this prospect. But there are numerous other arrows, representing other producers, who similarly are directing their sales effort from other angles, all converging on the same prospect. These other arrows, or means of prospect approach, should be used by us if we are to reach a full measure of success.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

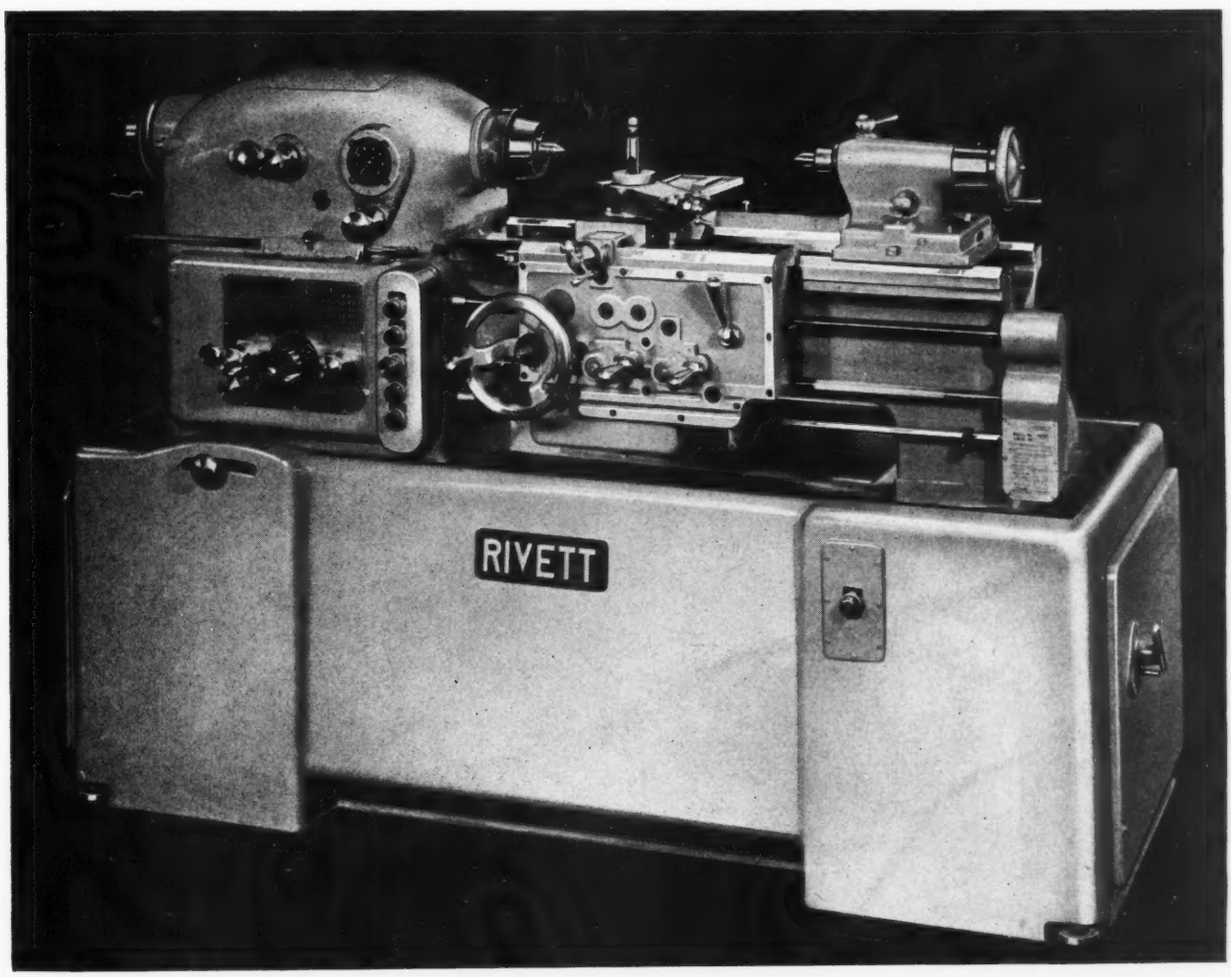
Rivett Double-Duty Tool-Room Lathe

A new precision tool-room lathe designed to provide increased power and rigidity is announced by Rivett Lathe & Grinder, Inc., Boston, Mass. This lathe, which has a 12 1/2-inch swing and a capacity of 20 inches between centers, is capable of handling any tool-room turning work within its range. It is adapted for both sensitive instrument work and heavy cutting with carbide tools.

Several unusual features have been incorporated in the new Model 1020S lathe to provide exceptional versatility. These include increased power, assured by the heavier weight (4000 pounds) which is 40 per cent greater than previous models; the provision of headstock back-gearing with a speed range of from 22 to 400 R.P.M.; and a bed with 12 3/4-inch wide steel ways, which are uniformly heat-treated to a hardness of 60 Rockwell C.

Features contributing to the precision of the lathe are three-bearing spindle mounting; free spindle, operating at infinitely variable speeds up to 3600 R.P.M.; collets that can be mounted directly in the spindle without an adapter; hardened and ground feed-screws; anti-friction bearings; and a gear-box providing seventy-two feeds and eighty-four threads, including all standard threads.

Operating convenience is provided by push-button controls for the variable-speed drive and the electrically operated carriage; a neutral clutch for stopping the spindle without stopping the drive; and a handwheel designed to facilitate turning the headstock spindle. 45



Rivett precision tool-room lathe, designed for both sensitive instrument work and heavy turning with carbide tools

To obtain additional information on equipment described here, use Inquiry Card on page 225.

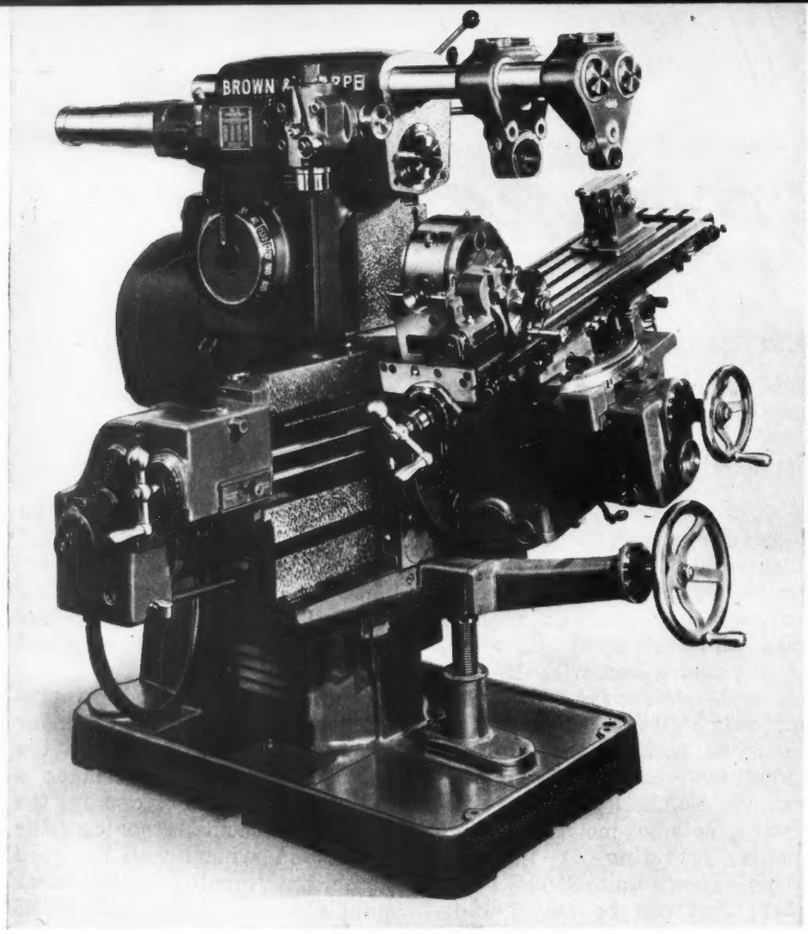


Fig. 1. "Omniversal" milling machine brought out by the Brown & Sharpe Mfg. Co.

B & S "Omniversal" Milling Machine

A No. 0 "Omniversal" milling machine, designed primarily for tool-room and experimental laboratory milling, has just been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. This machine has all the fundamental movements and adjustments common to the universal milling machine, and in addition, has an angular adjustment of the table in a vertical plane at right angles to the spindle and a horizontal feed of the entire knee assembly in the same plane.

It is also equipped with a versatile gear-driven "Omniversal" milling head, shown in Fig. 3, which is adjustable parallel to the over-arms; is arranged for universal angular adjustment; and has a 2-inch hand-feed for the spindle. This head can be used independently or in conjunction with the machine spindle. Thus the head provides an easy and accurate means of obtaining both simple and compound angular settings in any plane. Often work can be milled in several planes,

Fig. 2. Milling machine shown in Fig. 1 equipped for cutting a spiral taper reamer

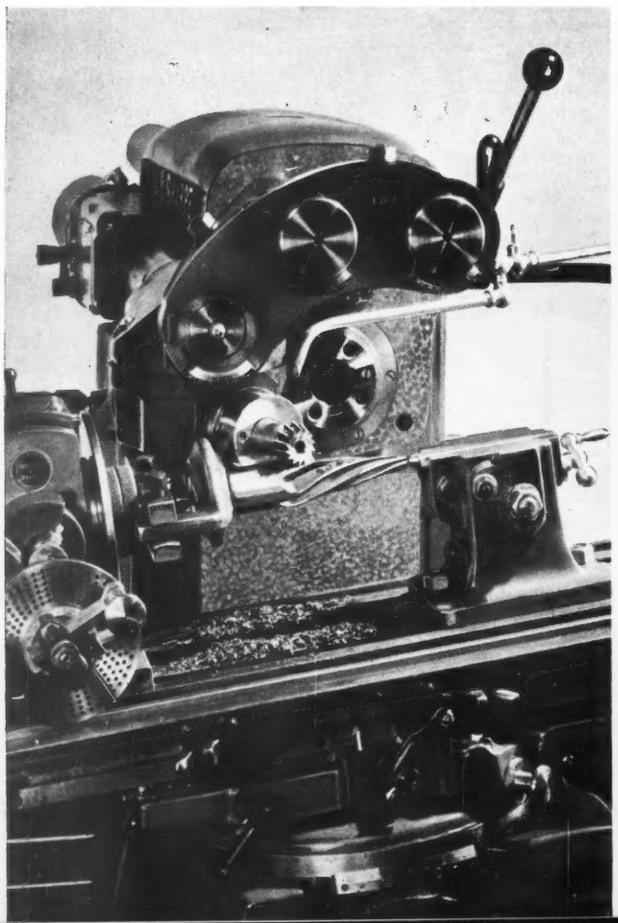
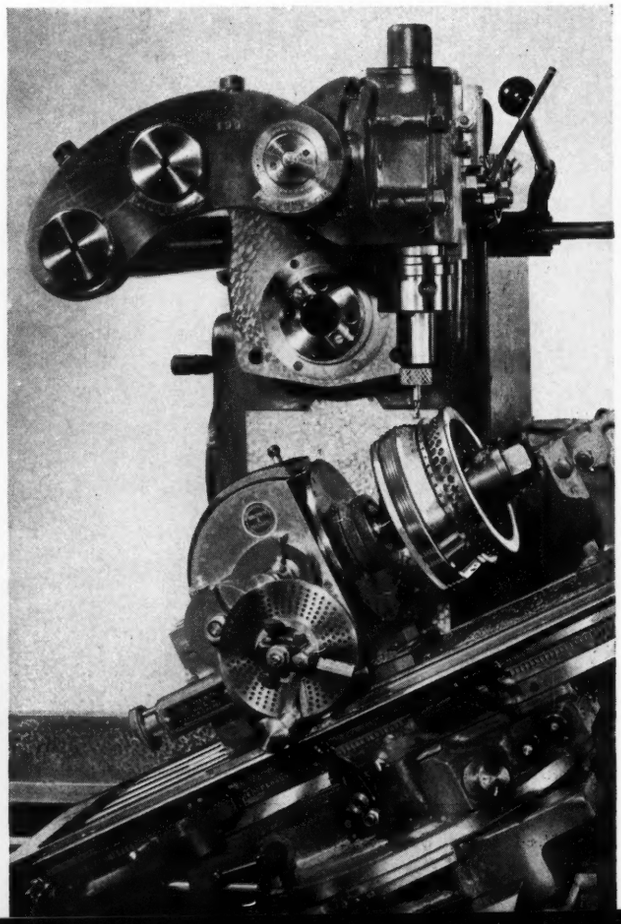


Fig. 3. B & S "Omniversal" milling head set up for milling accurately spaced angular holes



or drilled, bored, or reamed at many different angles without the use of special fixtures or attachments and without the need of relocating the work.

Eighteen spindle speeds are available, ranging from 40 to 1530 R.P.M. for the machine, and from 76 to 2900 R.P.M. for the "Omniversal" head, with an infinite number of feed changes from 1/2 inch to 15 inches per minute to meet a wide variety of milling requirements.

The new milling machine incorporates improved electrical controls, automatic lubrication, heavy column with extended spindle face, and convenient speed and feed controls. 46

Bliss Four-Point Eccentric Presses

A new line of four-point, single-action, under-driven eccentric presses, designated SU-4, has been announced by the E. W. Bliss Co., Canton, Ohio. These presses have been designed to meet the requirements of a wide range of applications in the forming of large-area metal stampings. As "down" time cannot be entirely avoided in the operation of these presses under continuous production conditions, they were designed to facilitate part replacements and make general maintenance as easy as possible.

The line includes sixty-three standard sizes with capacities ranging from 300 tons up to 3000 tons and bed areas from 72 by 48 inches to 300 by 108 inches. Presses of heavier capacities, however, can be built to order. All bearings of these presses are made so as to permit the shafts to be dropped straight down, without the necessity of pulling. The presses are double-geared, with the driving eccentrics cast integral with the main drive gears. All gears can be arranged to run in oil.

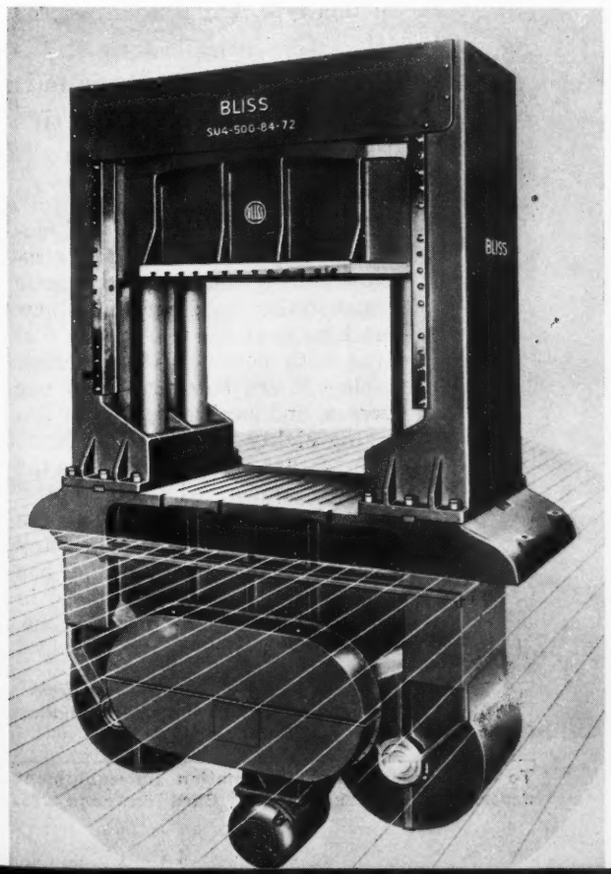
The fast-acting, single-disk, pneumatic friction clutch is standard equipment. This clutch does not require adjustment for wear, and friction plates are arranged for rapid heat dissipation. When worn out, the plates can be removed and replaced quickly without disassembling the clutch. Side posts are fully skirted at the connection joint, and are provided with internal pre-shrunk steel tie-rods which absorb the work load. The motor-driven slide-adjustment mechanism meshes with external threads at the top of the side posts, allowing extremely long adjustment where desired by merely lengthening the threaded portion of the posts. Since the work load is carried entirely by these side posts, there is no need for tie-rods in the frame of the press. The frame uprights are full box sections and have wide bases for exceptional rigidity. 47

Curtis "Straight-O-Matic" Abrasive-Belt Grinding and Polishing Machines

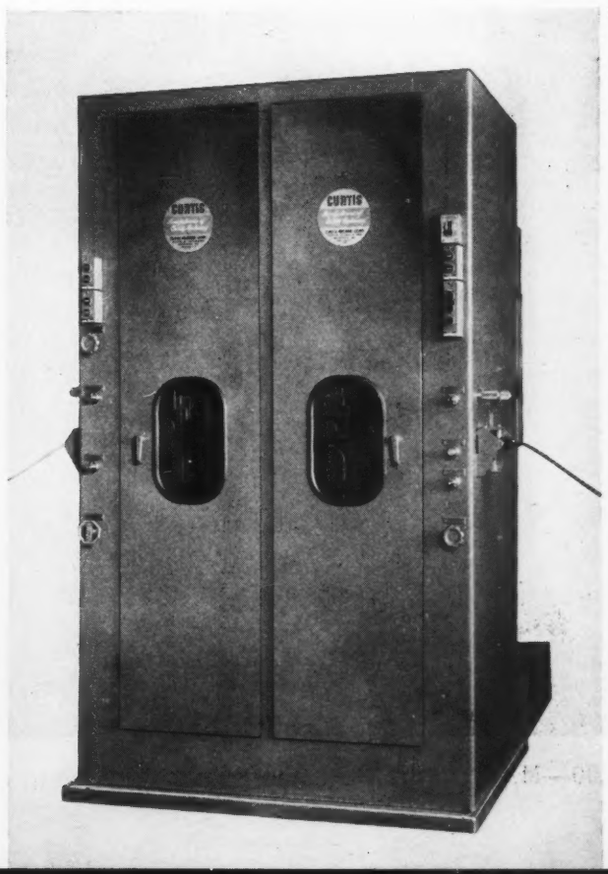
The Curtis Machine Division, Lincoln Park Industries, Jamestown, N. Y., has added a Model 600 AA to its recently developed line of "Straight-O-Matic" abrasive-belt grinding and polishing machines. This is a large completely enclosed machine designed for heavy-duty mill grinding with a 3-inch thickness adjustment. It surfaces both sides of long metal strip, bar, or coil stock, can be equipped for either dry or wet operation, and has a roll feed, with variable stock speeds of from 20 to 60 feet per minute. Any desired feed can be furnished.

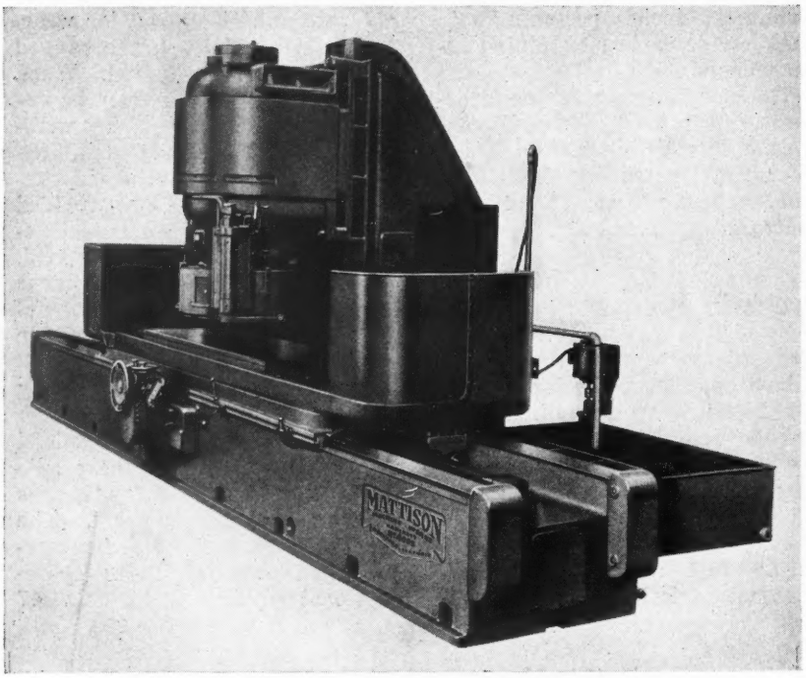
The 600 AA machine is espe-

Four-point eccentric press for forming large-area metal stampings, announced by E. W. Bliss Co.



Curtis new Model 600 AA "Straight-O-Matic" abrasive-belt grinding and polishing machine





Hanchett vertical-spindle surface grinder equipped for rapid stock removal, built by Mattison Machine Works

cially adaptable to in-line tandem mounting, with each unit using a progressively finer grit for high-quality finishes. All controls are at the front of the case and large double doors provide easy access for belt changing. The grinding assembly, including contact roll, motor, and drive, is mounted on slides, and pressure is applied by moving the heads vertically.

This model is regularly equipped for dry grinding with two 4-inch dust collecting manifolds joining into one 6-inch outlet at the back of the machine. For wet grinding, the machine is internally piped, having flat jet nozzles at both sides of each contact roll for ample belt cleaning. Both contact and "billy" rolls are easily changed when desired. Optional features, at slight extra cost include either air or solenoid automatic controls for "billy" roll pressure, and automatic belt tensioning.

The machine is 61 inches wide, 46 inches deep, and 100 inches high. The work height is 51 inches. The abrasive belt is 1 to 10 inches wide and 88 inches long. The net weight of the machine is 6000 pounds. ----------48

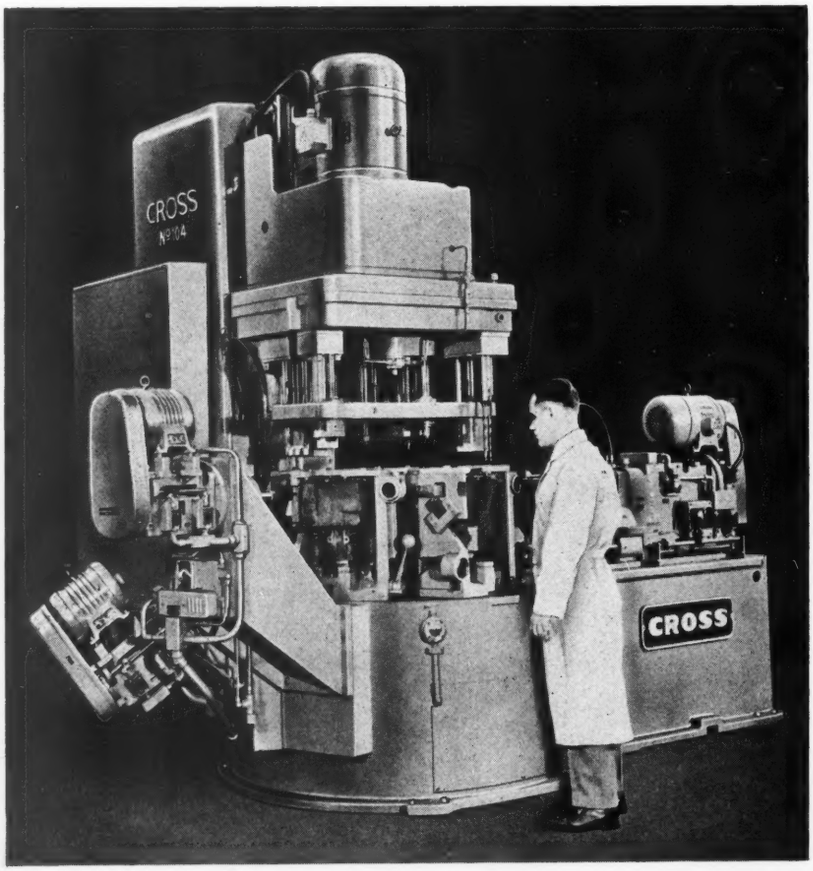
Vertical-Spindle Surface Grinder Equipped with Extra Large Motor

The Mattison Machine Works, Rockford, Ill., have just added a No. 400S machine to its line of Hanchett type vertical-spindle surface grinders. This machine, which is being used for reconditioning large-size dies in an automotive plant, is adapted for heavy production surface grinding where quick stock removal, combined with accuracy, is an important factor. It is equipped with a 100-H.P. motor, believed to be the largest ever used with a machine of this type. ----------49

Cross Machine Designed for Finishing Automatic Transmission Cases

The Cross Company, Detroit, Mich., has just built a special machine designed for drilling, reaming, and spot-facing automatic transmission housings. The new machine is of the five-station dial type with power-driven indexing table. It can be operated by one person, and has a capacity for finishing eighty-five pieces per hour.

A feature of this machine is the recently announced Cross control unit with "Toolometer." This device stops the machine when any tool requires changing and has provision for changing tools in groups to reduce "down" time.



Special machine built by The Cross Company for machining automatic transmission cases

To obtain additional information on equipment described here, use Inquiry Card on page 225.

Preset tools further reduce "down" time by eliminating the necessity for making adjustments after tool changes.

Other features include automatic lubrication, J.I.C. standard hydraulic and electrical installations, and the use of standard subassemblies to facilitate maintenance. 50

Natco Automatic High-Speed Drilling Machine

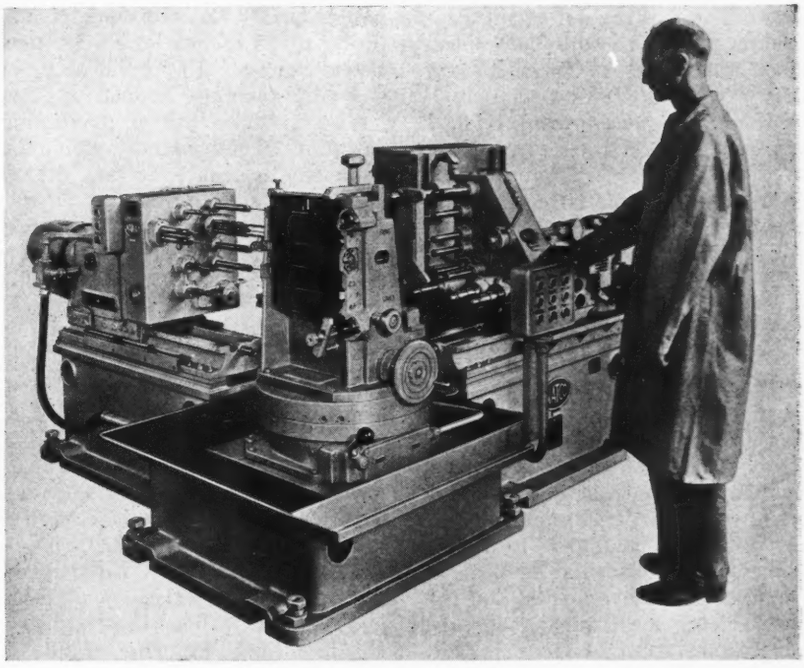
An automatic high-speed machine capable of drilling 1600 small holes in six faces of fifty plastic cash register drawers per hour has just been built by the National Automatic Tool Co., Inc., Richmond, Ind. This machine is equipped to drill holes ranging in size from 0.098 to 0.199 inch in diameter. In operation, one part is removed while another part is being relocated, and a new piece is being loaded into the work-holding fixture in the first position.

The rear head can be located in two positions. In the first position, it drills two holes, each 0.113 inch in diameter. In the second position, it drills two 0.1405-inch holes and four 0.113-inch holes.

Simultaneously with the second operation performed by the rear head, the right-hand head drills three 0.113-inch diameter holes. The work-holding fixture is then indexed 180 degrees, after which the rear head drills four 0.1015-inch diameter holes and four 0.199-inch diameter holes in the first position. Then the rear head drills two 0.1405-inch diameter holes and four 0.113-inch diameter holes in the second position, while the right-hand head drills seven 0.098-inch diameter holes. The work-holding fixture is then indexed 180 degrees to the loading position, thus finishing one complete cycle. 51

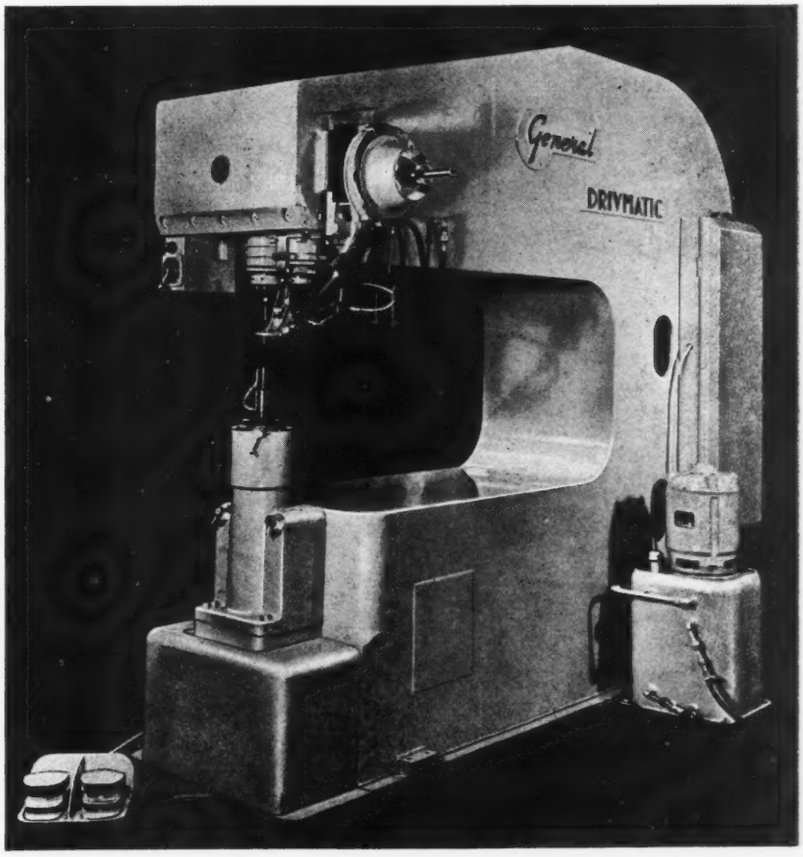
"Drivmatic" Milling and Riveting Machine

General Riveters, Inc., Buffalo, N. Y., has announced a new Model G 39A drill riveter, which is especially adapted for use in aircraft plants. This machine is an advanced design of the model that was developed during the second World War.



Automatic sensitive drilling machine for high-speed production of plastic parts, brought out by the National Automatic Tool Co., Inc.

The new "Drivematic" automatically drills and countersinks a hole, feeds a rivet into the countersunk hole, and then heads it. All four of these steps are performed in a continuous automatic cycle by simply positioning the work and depressing the footswitch. Simplicity and ease of operation, speed, and high quality of work on both flat and contoured parts are outstanding fea-



Automatic drilling, countersinking, and riveting machine announced by General Riveters, Inc.

To obtain additional information on equipment described here, use Inquiry Card on page 225.

tures. The drilling out of unsatisfactory rivets is said to be reduced to a minimum, while mutilation of the work is eliminated.

The work-pieces are clamped securely during the entire cycle of the machine, producing accurate holes without burrs. The standard machine has a capacity for drilling to a maximum depth of 1 3/8 inches. When operated automatically, it will feed rivets up to 1 1/8 inches long. Longer rivets can be fed by hand or by a specially designed hopper.

The machine has a maximum force of 16,000 pounds, which is sufficient to head 5/16-inch diameter solid aluminum-alloy rivets. Production speed on average work is about fifteen headed rivets per minute. 52

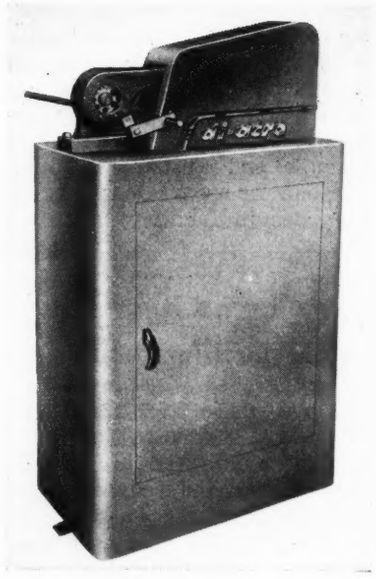
Improved Metallograph

The American Optical Co., Instrument Division, Buffalo, N. Y., has brought out a new metallograph having an improved optical system and controls, designed for greater convenience and simplicity of operation. The 5- by 7-inch camera, the monocular or binocular microscope eye-pieces, and the ball-bearing mechanical stage are directly in front of the operator. Also within easy reach is the electrical control panel for the arc and visual lamps. The four objectives on the rotating turret, the photographic eye-pieces mounted on a quick-change slide, the camera shutter, and the color filters are operable from a sitting position.

Grain size measurements of ferrous or non-ferrous metals are compared directly on the ground glass with standard grain-size charts. Case depth and linear measurements are easily and accurately made with an accessory micrometer rule. Selection of magnification is a very rapid procedure. The objective, eye-piece, and camera bellows setting are all identified by the standard A.S.T.M. magnifications. These range from 50X to 1500X, with 2000X obtainable on request.

A built-in visual lamp permits the arc lamp to be used for photography only. Either a ribbon-filament tungsten lamp or a fully automatic motor-driven arc lamp can be used. 53

Metallograph of improved design announced by the American Optical Co.



Power-operated rod cutting-off machine made by O'Neil-Irwin Mfg. Co.

Di-Acro Power Parter for Cutting Off Rods

The O'Neil-Irwin Mfg. Co., Lake City, Minn., has brought out a power-driven rod-parting machine with a capacity for cutting off rods up to 5/8 inch in diameter. The parter is equipped with an air cylinder, cushioned at both ends for quiet, efficient operation, and each cutting cycle is instantly obtained through a four-way foot-valve, which leaves both hands of the operator free to handle the material.

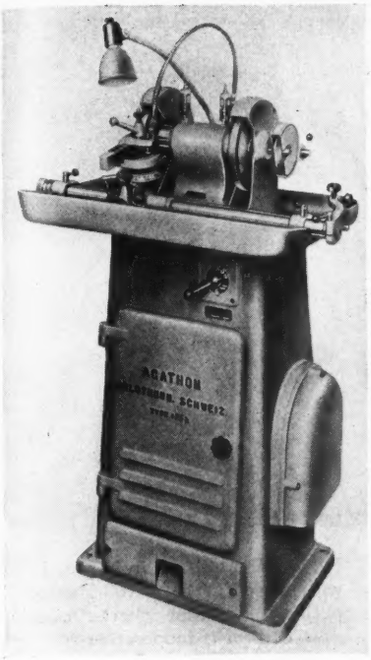
The standard cutting head has ten holes ranging from 1/16 to 5/8 inch in diameter in steps of 1/16 inch. Special size round holes can also be provided. Square, rectangular, hexagon, and other shaped bars can be cut satisfactorily, and cutting heads can be made to order for these operations.

The "Ejectomatic" gage supplied with the parter allows the three separate operations of gaging, parting, and ejecting to be performed in a single cycle. The machine requires a floor space of 15 by 28 inches, is 40 inches high, and weighs 260 pounds. 54

Agathon Tool Grinding and Lapping Machine

The Hauser Machine Tool Corporation, Manhasset, N. Y., has announced that it is now making available to industry in this

To obtain additional information on equipment described here, use Inquiry Card on page 225.



Agathon tool grinding and lapping machine introduced in this country by the Hauser Machine Tool Corporation

country the Agathon Type 175A precision tool grinding and lapping machine made by Agathon, Ltd., Soleure, Switzerland. This machine, through its patented principle of grinding and lapping, is designed to eliminate guesswork and dispense with the necessity of checking and rechecking tool angles. The tool to be ground is held in a special compound holder which slides on a bar parallel to the wheel spindle, so that, after grinding each surface of the tool, it is only necessary to move the holder to the lapping wheel for a final finishing operation to complete the job.

Tools from the smallest cross-section up to 1.57 by 2.36 inches, for example, can be ground and lapped with great accuracy and rapidity on this machine. Wheels can be changed quickly and easily for high-speed steel or hard metal tools, and the flexible coolant nozzle allows the operator to direct a stream of coolant to the precise spot desired. Provision is made for grinding chip breakers and curlers.

Special attachments provide for accurate grinding and lapping of cutter-heads, engraving tools, round boring tools, and other special tools, making this machine one of the most versatile tool grinders available. ----------55

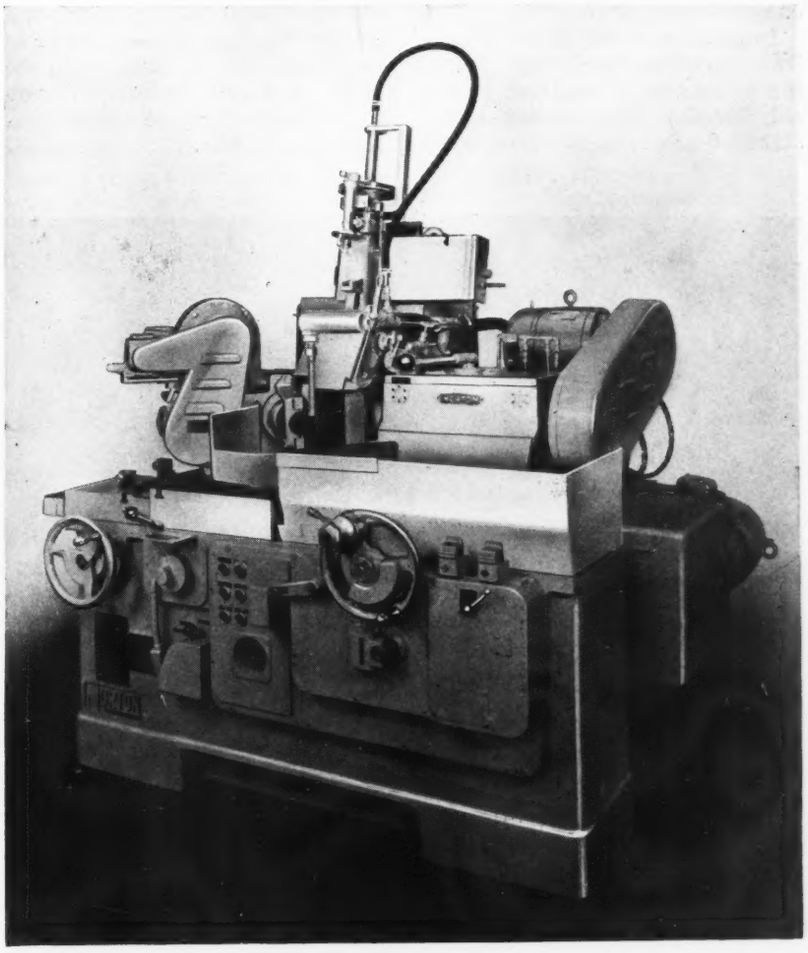
Norton Semi-Automatic Valve Grinder

A new valve grinder has been designed by the Norton Co., Worcester, Mass., to meet the needs of the automotive and aircraft industries for high speed production combined with semi-automatic operation, high precision, and fine finish. This machine grinds the faces of automotive and aircraft type valves having face angles from 0 to 62 1/2 degrees, with face diameters of 7/16 inch through 3 1/2 inches, and stem diameters up to and including 3/4 inch.

The grinding cycle functions under semi-automatic control. Operating effort is confined to loading the machine and to the manipulation of a single control lever. Movement of this lever clamps the work-piece in the work-head collet and starts the grinding cycle, rotation of the work-piece, and coolant flow.

An ultra-fine feed rate is available for the final automatic feed stage. This fine feed can be engaged by a simple adjustment at any point in the wheel-feed cycle after the work has been ground to within 0.005 inch of the finish size. Spindle reciprocation is also a feature contributing to quality of finish and improved wheel cutting action. Termination of the grinding cycle is brought about automatically by an electric timer, set to obtain the particular size and finish desired. Termination of work-piece rotation and coolant flow, as well as unclamping of the work, also occurs automatically on completion of the cycle.

The spindle of the work-head unit carries a draw type, hydraulically operated chuck. A radially adjustable faceplate provides for centralizing the work with respect to the center of the spindle, and end-stops control location of the ground surface relative to the wheel. The work-head unit turns through an arc of 67 degrees on a swivel plate having micrometric adjustment. This plate is mounted on a sliding table, and movement of the unit



Semi-automatic valve grinding machine brought out by the Norton Co.

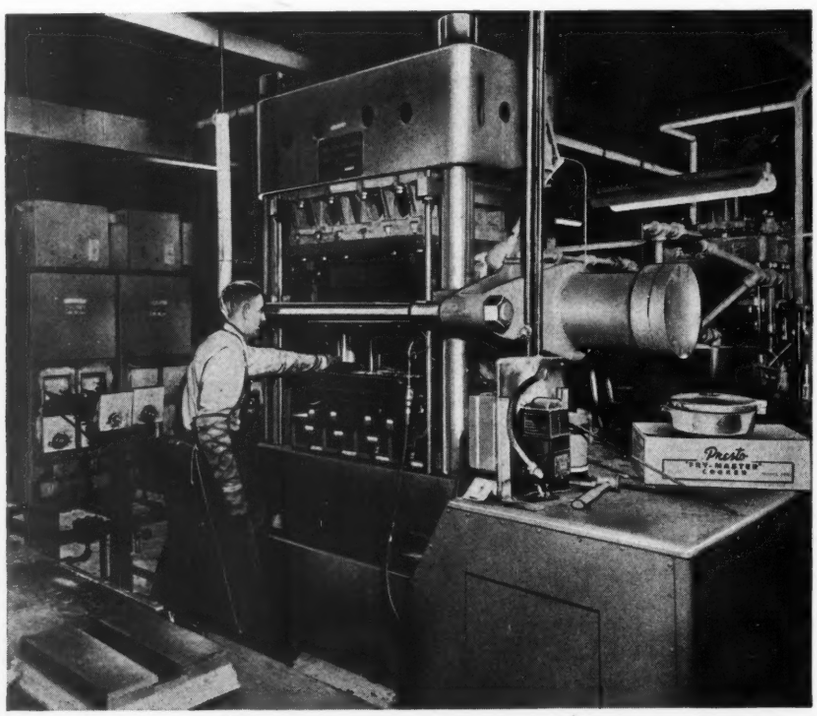
into the grinding position, or away to provide clearance for wheel removal, is accomplished quickly by means of a conveniently located handwheel.

Wheel truing is accomplished by a wheel guard truing device which operates automatically and at the will of the operator through hydraulic power. Movement of a lever on the wheel-spindle housing is all that is needed.....56

Elmes Angle-Transfer Molding Press with Horizontal Rams

High-speed operation, increased production, and exceptional ease of control are advantages claimed for a new angle-transfer press for plastics molding recently developed by the Elmes Engineering Division of American Steel Foundries, Cincinnati, Ohio. Basically, this is a standard Elmes 300-ton compression molding press modified to meet special requirements. It is equipped with two 50-ton horizontal transfer rams, and averages twenty-seven to thirty-one cycles per hour.

In addition to handling specialized quantity production work, this press can be employed profitably for short-run molding, using standard die sets, for processing a variety of parts simultaneously. Extra large die space, readily accessible from front and back, makes die installation easy and permits faster loading of preforms. The press is push-button controlled and has an automatic time cycle. The press is shown in the illustration as installed in the plant of Martin Motors, Division of National Pressure Cooker Co., Eau Claire, Wis. 57



Molding press of angle-transfer type with two horizontal rams, placed on the market by the Elmes Engineering Division of American Steel Foundries

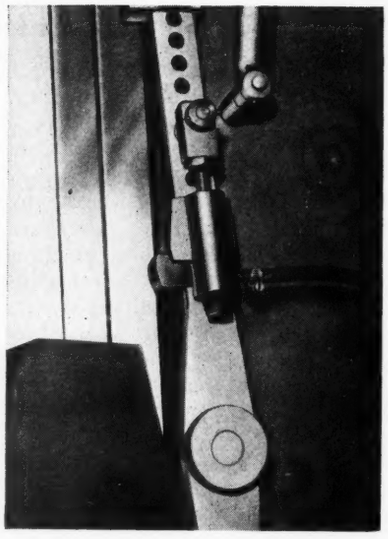


Fig. 1. Chambersburg short-stroke control for drop-hammer with wedge down to hold dog in short-stroke position

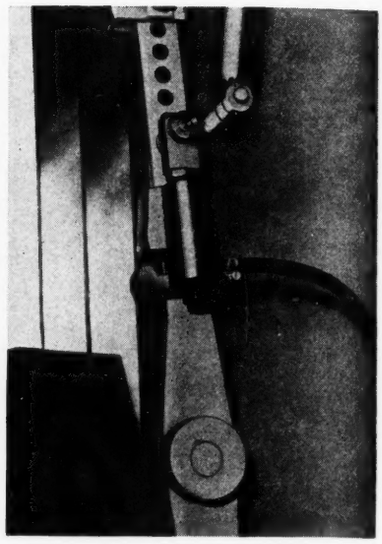


Fig. 2. Control shown in Fig. 1 with wedge lifted to full-stroke position, so that short-stroke control is inoperative

Short- or Long-Stroke Control for Chambersburg Drop-Hammer

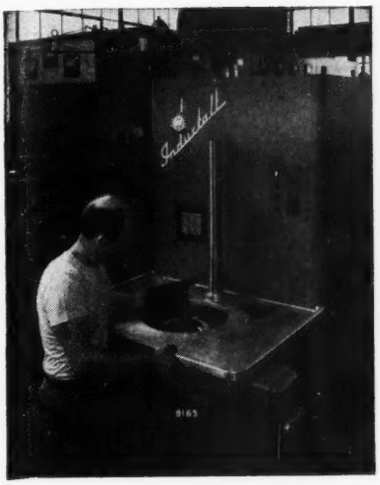
Short-stroke control for the "Ceco" drop-hammer has just been announced by the Chambersburg Engineering Co., Chambersburg, Pa. This patented device, comprising an air-operated dog attached to the rocker that controls the action of the valve, can be applied to any "Ceco" drop-hammer having a capacity of 1000 pounds or more.

Pressure on a push-button on the treadle changes the stroke. It can be arranged as seen in Fig. 1, so that the machine normally operates on the short stroke and changes to the long stroke only when pressure is applied to the push-button or it can be arranged as shown in Fig. 2 so that the long stroke is normally in operation and the change to short stroke is obtained by pressure on the treadle push-button. Normal operation is resumed on release of the push-button. With this control, the sequence of blows is uninterrupted, and both short and full strokes fall freely.....58

Westinghouse Radio-Frequency Gear-Hardening Machine

A radio-frequency gear-hardening machine for high-production heat-treating of gears has been brought out by the Westinghouse

To obtain additional information on equipment described here, use Inquiry Card on page 225.



Westinghouse radio-frequency gear-hardening machine

Electric Corporation, Pittsburgh, Pa. This machine, designated the "Inductall," is used with a vacuum-tube radio-frequency generator, a 10,000-cycle motor-generator set, and other associated equipment to harden spur gears, cluster gears, integral spindle gears, and shafts. It carries each gear through an automatic cycle for either "through" or contour hardening. Uniformity of hardening results from the mechanical gear-handling system and precise electric timing of the preheating, heat-treating, and quenching operations.

The "Inductall" system is said to be flexible and to lend itself readily to expansion as required for increased production. Being simple to operate and maintain, it does not require skilled operators. The equipment is designed for in-line production methods. Automatic loading and unloading magazines are available as optional accessories. 59

Power Units for Nelson Welding Equipment

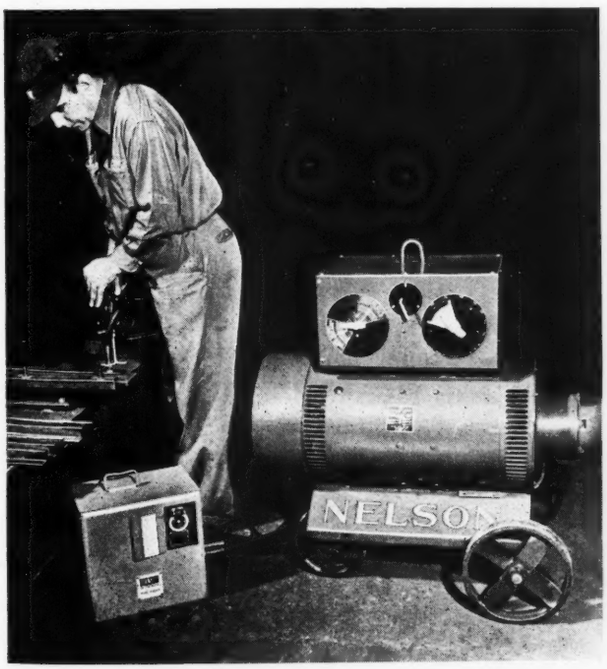
Two special power units, specifically designed for use with Nelson stud-welding equipment, have been announced by the Nelson Stud Welding Division, Morton Gregory Corporation, Lorain, Ohio. The motor-operated generator unit illustrated is capable of welding studs up to and including 5/8 inch in diameter. This unit weighs approximately 800 pounds, and can be operated on either 220- or 440-volt, 60-cycle alternating current.

The other unit (not shown) is battery-operated, and can be used for installing studs up to 1/2 inch in diameter. Requiring only a 110-volt alternating-current outlet for its source of operating current, it is especially useful for construction jobs where welding generators or other power is not available. This unit weighs about 1100 pounds. 60

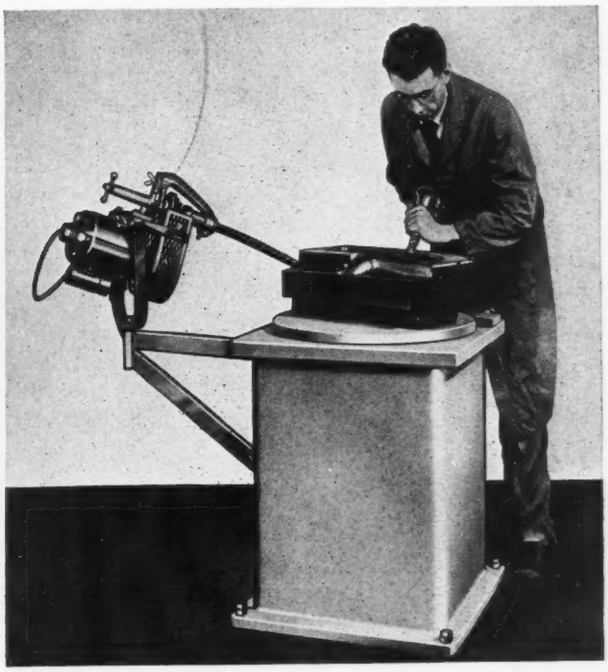
Pratt & Whitney Stand for Handling Heavy Dies

Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., has brought out a "Di Ro" stand, designed for use on its Kellerflex flexible-shaft machines to facilitate the handling of heavy dies, molds, patterns, and castings during hand-finishing operations. This sturdy stand, of welded construction, is 2 feet square by 30 inches high, and has a turntable on which heavy work can be rotated freely, allowing the operator to work from one location. The turntable is mounted on a heavy-duty thrust bearing, protected from dust and chips, and is capable of handling loads up to 3 tons. Provision is made for locking the table in any position desired by means of a quick-acting clamp.

A hinged arm, attached to the side of the stand, is provided to support the Kellerflex, so that it will swing in an arc of 180 degrees, giving the operator freedom of movement with the handpiece and keeping the flexible shaft clear of the work. A storage compartment inside the stand provides safe keeping for accessories and tools. Although designed for use with Kellerflex equipment, this stand can be adapted for use with any other flexible-shaft machine or portable grinder. 61



Motor-operated generator set designed for use with Nelson stud-welding equipment



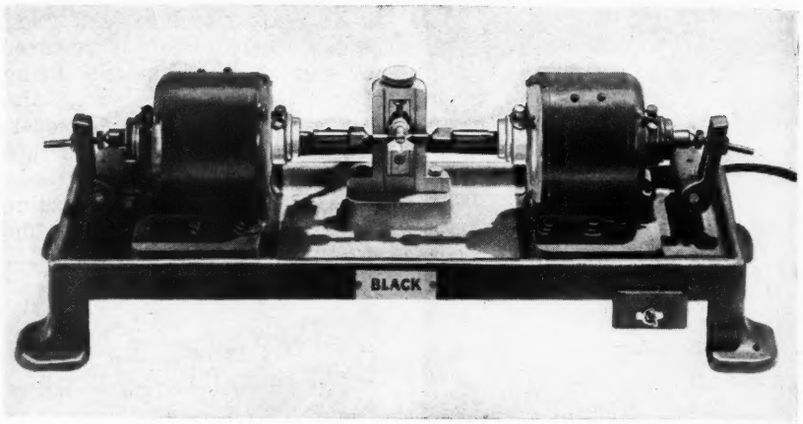
"Di Ro" stand for easy handling of heavy dies, announced by Pratt & Whitney

To obtain additional information on equipment described here, use Inquiry Card on page 225.

Production Countersinking, Chamfering, and Burring Machine

A new machine designed to perform countersinking, chamfering, and burring operations at high production rates is being manufactured by the Black Drill Co., Cleveland, Ohio. This machine consists of a cast-iron base on which are mounted two traversing shaft motors with opposed cutting tools mounted in collets at the ends of the shafts, and a toolpost and work-holder located at the center of the assembly. The work-holder is made of tungsten steel to minimize wear. Micrometer adjustment is provided for the toolpost.

The tools are brought to the work by depressing a foot-pedal which actuates both shafts simultaneously. Each shaft is equipped with a micrometer adjustment for close control of the cutting depth. Motors of from 1/3 to 1 H.P., with speed ratings of 600 to 3600 R.P.M., can be used, depending upon the size and kind of material to be machined and the cutting speed employed. The maximum stroke, limited by the motor shaft travel, is 2 inches, permitting a wide variation in the type and size of work that can be handled. A single motor unit can be supplied for work that does not require the two-motor set-up. 62

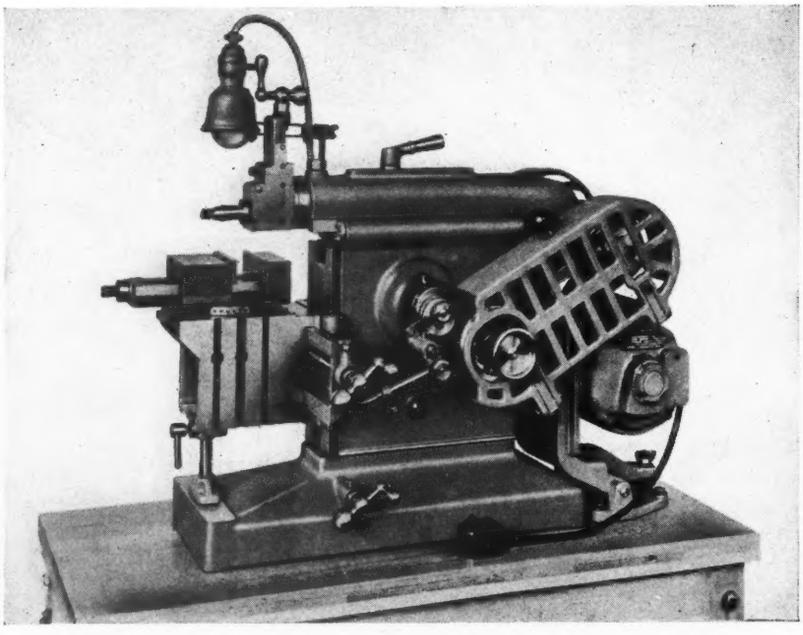


Countersinking, chamfering, and burring machine manufactured by the Black Drill Co.

Delta Metal-Working Shaper

A 7-inch precision metal shaper, priced within a range intended to make it available to small shops, has been added to the line of metal-working machines made by the Delta Power Tool Division, Rockwell Mfg. Co., Milwaukee, Wis. This shaper has the same general features as the larger Delta machines. It is said to make possible savings in time, labor, floor space, power, and set-up expense on work requiring a shaper stroke of 7 inches or less as compared with costs for handling such work on larger shapers.

The new shaper has four speeds —40, 70, 115, and 180 strokes per minute—and the maximum length of stroke is 7 3/4 inches. The table has a horizontal travel of 9 1/2 inches and a vertical travel of 4 1/4 inches. Feeds range from 0.003 to 0.018 inch. The adjustable tool-head is graduated from 0 to 90 degrees for angular work, and has a vertical travel of 3 1/4 inches. The vise has a maximum opening of 4 1/4 inches. Available attachments include a portable cabinet, rotary table, index-centers, keyway cutting tools, and an angle-plate. 63



New small size shaper placed on the market by the Delta Power Tool Division, Rockwell Mfg. Co.

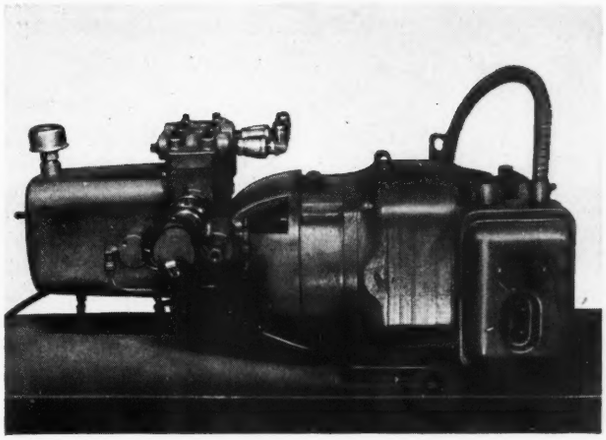
Units Designed for Operating Hydraulic Equipment

A complete line of hydraulic units, available in 118 models with capacities ranging from 1.8 to 8.25 gallons per minute and developing pressures up to 1000 pounds per square inch, has been announced by Harco Industries, Inc., Rochester, N. Y. These units incorporate motors from 1/3 to 5 H.P. with manual, electro-pneumatic, or hydraulic control.

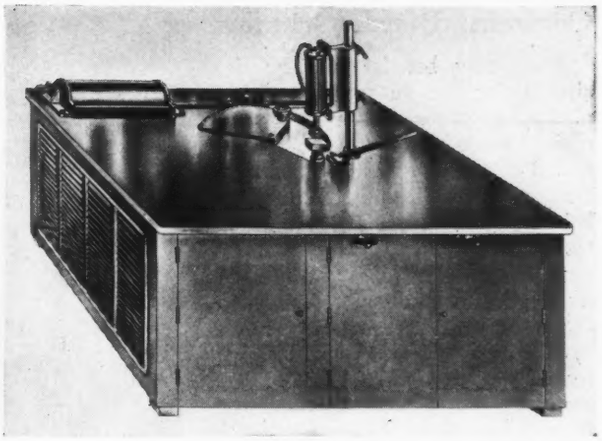
The accompanying illustration shows a 2-H.P. unit having a capacity of 3.3 gallons. It has an electro-pneumatic control for automatic cycling through snap-action switch initiation. This machine is especially adapted for maintenance work, as it can be easily removed to repair shops or replaced with a duplicate unit to eliminate "down" time of a production machine.

The complete unit includes a totally enclosed motor, solid coupling, vane type pump, reservoir,

To obtain additional information on equipment described here, use Inquiry Card on page 225.



Units for operating hydraulic equipment made by Harco Industries, Inc.



Drawn-shell trimming machine announced by the Dayton Rogers Mfg. Co.

oil cooler, air filter, overload valve, pressure regulating valve, and a three- or four-way valve, or a combination of these valves arranged to suit requirements.....64

Wells Metal-Cutting Saw

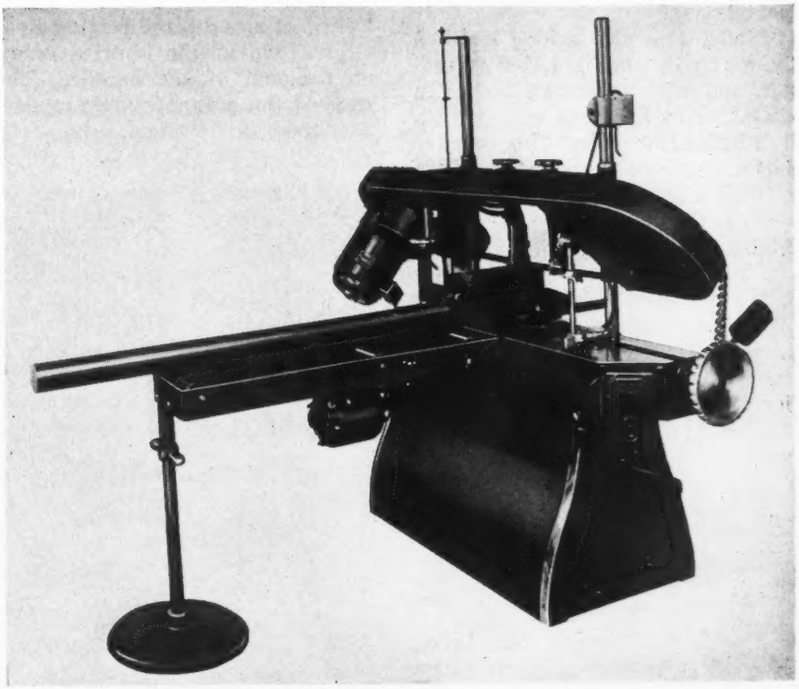
W. F. Wells & Sons, Three Rivers, Mich., has announced the second of a series of metal-cutting saws. This new machine, designated Model D, has a capacity for cutting off metal bars 14 by 18 inches and is designed to handle the larger class of cutting work. It is also said to be adapted for handling many machining jobs ordinarily done on milling and planing machines, such as slotting, removing corners of die blanks, etc. The cutting head is equipped with a blade 14 feet 5 inches by 1 inch by 0.035 inch and can be raised to give a maximum clearance of 20 inches under the saw blade.

The machine is designed for hydraulic operation, and can be set to automatically raise the saw blade at the completion of a cut and then start the down feed again without stopping the blade. With this arrangement, it is only necessary for the operator to feed the stock against the stop and tighten the vise. When equipped with an automatic vise tightener, the operator merely feeds the stock, and when equipped with an automatic bar feed, as shown in the illustration, the cutting of a bar into pieces of a uniform predetermined length is entirely automatic. The machine requires a floor space of approximately 22 by 78 inches. 65

Dayton Rogers Drawn-Shell Trimmer

An improved Model B drawn-shell trimming machine, designed to trim shells of practically any depth and up to a maximum wall thickness of 14 gage, has been announced by the Dayton Rogers Mfg. Co., Minneapolis, Minn. A simple tooling adapter is provided for any size or shape of shell up to a maximum diameter of 12 inches, making it possible to trim irregular shells with a minimum internal radius of 1/16 inch, as well as round or cylindrical shells. Only one external universal trimming cutter is needed.

The work-spindle is provided with a variable-speed drive that permits shells to be trimmed at the rate of 20 to 500 per hour, the actual production depending upon the size and shape of the shell. The machine is designed to handle all flat-edge trimming operations on drawn shells as well as to perform such operations as beading, forming, flanging, and other second operations with a minimum cost for special tools. The drive is through a 3-H.P. motor, and the machine has a weight of about 3000 pounds. 66

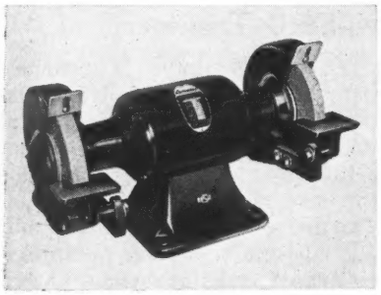


Metal-cutting saw for large work recently placed on the market by W. F. Wells & Sons

Cummins Bench Grinders

Four new bench grinders designed for use in metal-working plants, garages, or repair and maintenance shops have just been added to the line of the Cummins Portable Tools Division, Cummins Business Machines Corporation, Chicago, Ill. The Model 470 close-coupled grinder has a 1/4-H.P. motor, takes a wheel 6 inches in diameter by 1/2 inch wide with a 1/2-inch arbor hole, is 11 5/8 inches long by 7 5/8 inches high, has a base 6 7/8 inches deep by 6 inches wide, and weighs 32 pounds.

The Model 471 grinder has a long end bell, a 1/4-H.P. motor,



Bench grinder introduced by Cummins Portable Tools Division

takes a wheel 6 inches in diameter by 3/4 inch wide with a 1/2-inch arbor hole, is 16 inches long by 10 inches high, and weighs 38 pounds.

Model 475, also a long end-bell type grinder, has a 1/3-H.P. motor, and takes a wheel 6 inches in diameter by 3/4 inch wide with a 1/2-inch arbor hole. This grinder has a length of 16 inches, a height of 10 inches, and a base 8 inches deep by 7 inches wide. The weight is 40 pounds.

Model 478, another long end-bell type, has a 3/4-H.P. motor and uses a wheel 8 inches in diameter by 1 inch wide with a 5/8-inch arbor hole. It is 19 inches long by 12 inches high and weighs 85 pounds. All models have a wheel speed of 3440 R.P.M. 67

Starrett Short Small-Hole Gages and Telescoping Gages

The L. S. Starrett Co., Athol, Mass., has just brought out a new line of gages, shown in Fig. 1, for measuring holes, slots, grooves, and recesses ranging from 0.125

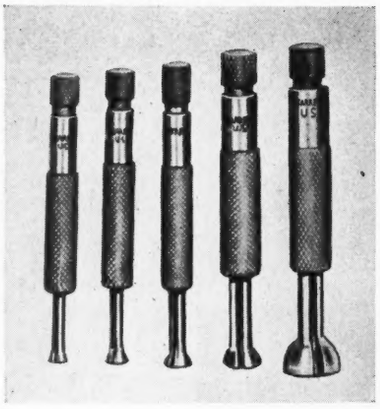


Fig. 1. Starrett short small-hole gages

to 0.500 inch, which are too small or shallow to be measured by the conventional telescoping gage.

These gages are adjustable for size by means of a convenient knurled knob at the end, which provides a smooth and sensitive adjustment. When used with a micrometer, the size of any hole or slot can be obtained to 0.001 or 0.0001 inch.

The new Starrett telescoping gages shown in Fig. 2 are being made in six sizes ranging from 5/16 inch to 6 inches. The self-centering handle of these gages remains centered and balanced, regardless of the setting of the two telescoping plungers.

Spring tension maintains uniform contact pressure on both plungers, which can be easily locked at any desired setting by a slight turn of the knurled screw on the end of the handle. The ends of the plungers are rounded, hardened, and ground. 68

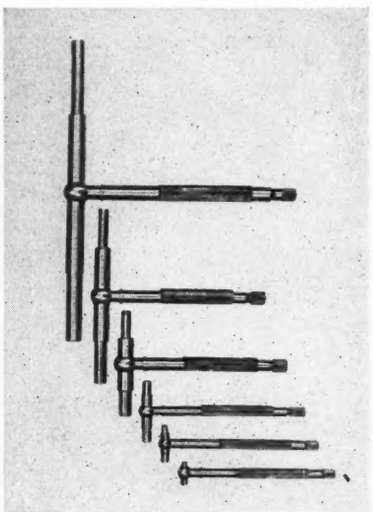
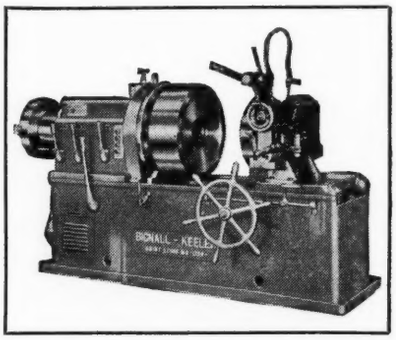


Fig. 2. Starrett telescoping gages with self-centering handles

B & K Pipe-Threading Machine

The Bignall & Keeler Division, John Ramming Machine Co., St. Louis, Mo., has redesigned its line of pipe-threading machines. These machines have been modernized in appearance and the controls have been made more accessible and easier to operate. They are ruggedly built to withstand continuous handling of tough threading jobs. The range of pipe sizes covered is from 1 inch to 8 inches.

Features of these machines include tapered roller bearings on all shafts and arbors; precision-



Bignall & Keeler redesigned pipe-threading machine

cut gears; automatic lubrication of gears and bearings; electrical reversing; power chucking; and a rugged carriage which can be positioned by accurately machined racks. 69

Onsrud Giant Size Airplane Spar Milling Machine

The Onsrud Machine Works, Chicago, Ill., recently completed what is believed to be the longest milling machine ever built. This special "spar miller," as it is called, has just been installed in the Boeing Airplane Co.'s Seattle plant. It has an over-all length of 105 feet.

Typical of the parts to be handled on this giant size machine are extruded airplane spars of tough aluminum alloys (usually 24S-T or 75S-T). These spars require many different types of milling operations, such as tapering cuts in the webs and flanges, and twist cuts along the length of the spar. The new machine has been designed to permit milling

To obtain additional information on equipment described here, use Inquiry Card on page 225.

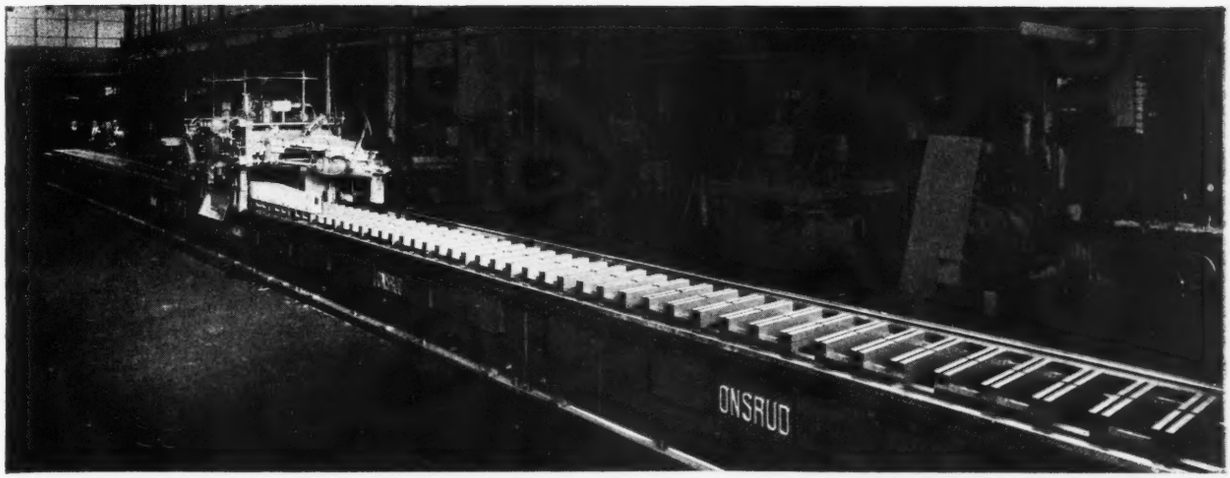


Fig. 1. Airplane spar milling machine built by Onsrud Machine Works, Inc.

the entire length of such parts and to take any type of milling cut required during one pass of the carriage. In addition, since the positions of the cutter-heads are controlled by the pattern or templet method, milling cuts can be made involving non-mathematical curves such as required in the machining of a great variety of aircraft parts.

The carriage of the machine houses four cutter motors—two vertical and two horizontal—with a total available power rating of 200 H.P. The carriage is driven from one end of the bed to the other by a direct-current motor and spiral-tooth rack assembly under electronic control. Carriage speed is infinitely variable from 10 to 200 inches per minute, and may be set to change automatically during the cutting operation to suit the work.

The cutter motor mounting assemblies provide for a variety of cutting positions. The vertical motors are mounted on parallel arms and slide up and down, and can also be tilted to permit cutting at various angles. Each motor can be guided for position separately under templet control. Similarly, the horizontal motors are adjusted to assume new positions for the cutters as the carriage travels along the bed.

Carbide-tipped cutters are used on this machine. The bed length is 90 feet, maximum carriage travel, 80 feet, and the weight about 120,000 pounds. 70

Tool Bits and Adapters for Standard Tool-Holders and Boring-Bars

A new principle of tool design has been employed by Speed Bits, Cleveland, Ohio, in designing a tool bit having two cutting sides, with chip-breakers the full length of its edges. This tool bit can be set for any desired side clearance angle or side rake angle. It is claimed that chatter and vibration are eliminated by the self seating and locking feature, which firmly locks the cutting tool to all four sides of the square or rectangular channel in a standard tool-holder or boring-bar.

The side clearance is established by the angle of the wedge-shaped member on the cutting side of the tool bit, seen in the illustration. The required side rake angle, positive or negative, is determined by the included

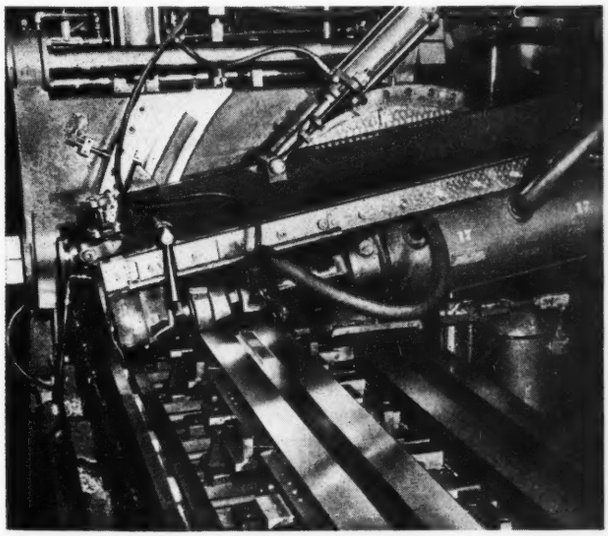
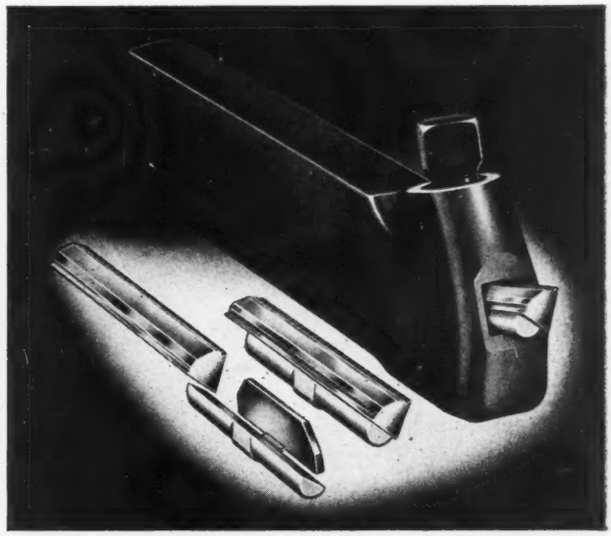
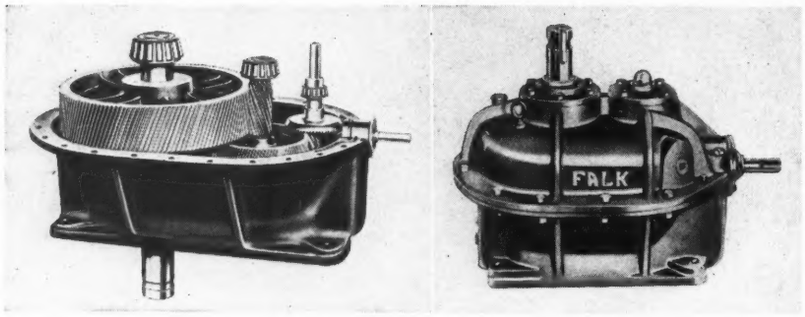


Fig. 2. Close-up view of a horizontal spindle motor on the machine shown in Fig. 1, tilted to mill a bevel on the work



Tool bits and adapters for use in standard lathe, planer, and shaper tool-holders and boring-bars, made by Speed Bits

To obtain additional information on equipment described here, use Inquiry Card on page 225.



(Left) Falk vertical right-angle triple-reduction speed reducer. (Right) Falk vertical right-angle double-reduction speed reducer

angle of the tool bit and chip-breaker.

The tool bit is furnished ground for the full length, and has two cutting edges with chip-breakers the full standard length. As the tool wears, only one flat grind or cut across the face is required to maintain the correct side clearance angle, front clearance angle, end cutting edge angle, side cutting edge angle, and side rake angle. The adapter or cradle is reversible, end for end, to permit right- or left-hand cutting.

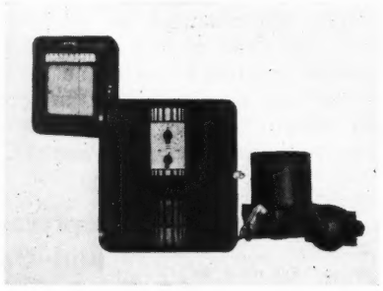
These tool bits are available in high-speed tool steel and cast-alloy materials, and in sizes from 1/8 inch to 1 1/8 inches. Inexpensive adapters can be obtained having wedges ground for establishing side clearance angles from 0 to 22 degrees. Tungsten-carbide tipped tool bits can also be supplied in standard sizes, ground ready for use. 71

Falk Parallel and Right-Angle Speed Reducers

The Falk Corporation, Milwaukee, Wis., has recently announced an improved line of parallel-shaft and right-angle speed reducers which includes both horizontal and vertical types. These speed reducers are designed for a wide variety of power transmission requirements, and cover an input speed range up to 1750 R.P.M.

Parallel-shaft speed reducers with either sleeve or roller bearings have the high mechanical efficiency of 96 to 98 1/2 per cent at full load. The ratio range is from 2.22 to 1 up to 300 to 1. These units are built in sizes of 15 to 2000 H.P. in the sleeve bearing type and 15 to 1500 H.P. in the roller bearing type.

Right-angle horizontal speed reducers are available in 15 to 1500 H.P. sizes, with a minimum ratio of 1.5 to 1 and a maximum ratio of 515 to 1. The right-angle vertical speed reducers have a ratio range of from 5.7 to 1 up to 430 to 1. They are built in sizes ranging from 15 to 1000 H.P. 72



Electric control system announced by Leeds & Northrup Co.

Leeds & Northrup Electric Control

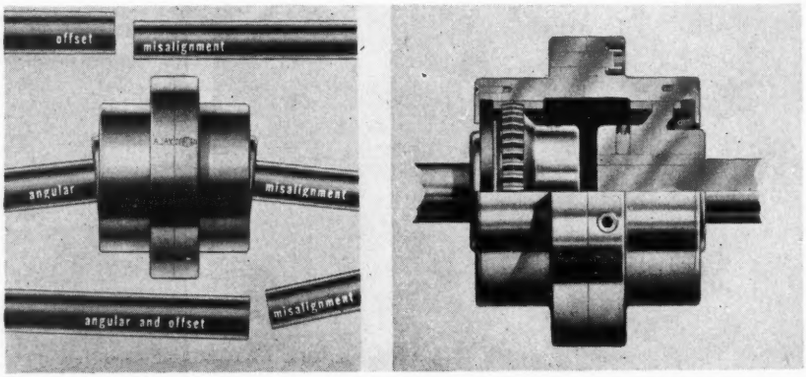
New electric control system, Model P.A.T. 50, announced by Leeds & Northrup Co., Philadelphia, Pa. Said to be first system in which rate action has been introduced into an electrically actuated control. Rate action responds according to the speed with which the control variable changes, and thus improves process output by reducing the length of time required for correction. If furnace temperature, for example, begins to fall, the rate action control immediately opens the fuel valve. The faster the drop in temperature, the wider the valve is opened. As the rate of temperature drop decreases, the rate action also decreases. Applicable to the regulation of temperature, chemical concentration, and gas analysis. 73

Ajax "Dihedral" Coupling

A new shaft coupling designed to operate under angular and offset misalignment conditions such as shown in the view to the left in the illustration has been brought out by the Ajax Flexible Coupling Co., Inc., Westfield, N. Y.

Standard Ajax "dihedral" couplings, as these new transmission units are called, will handle angular and offset misalignment up to 7 degrees, and special models can be built to take care of misalignment as great as 12 degrees. The dihedral surfaces of the splines are said to provide a larger tooth contact surface under operating conditions than the contact surface of teeth having any other shape. Under all practical conditions of misalignment, the driving area is at the center of the tooth, where it is the strongest.

The couplings are regularly made in eight sizes, with maximum bores ranging from 1 5/8 to 5 inches. The smallest size has a rating of 12 H.P. at 100 R.P.M. and a speed up to 12,000 R.P.M. The largest size has a rating of 350 H.P. at 100 R.P.M. and a speed up to 4300 R.P.M. 74



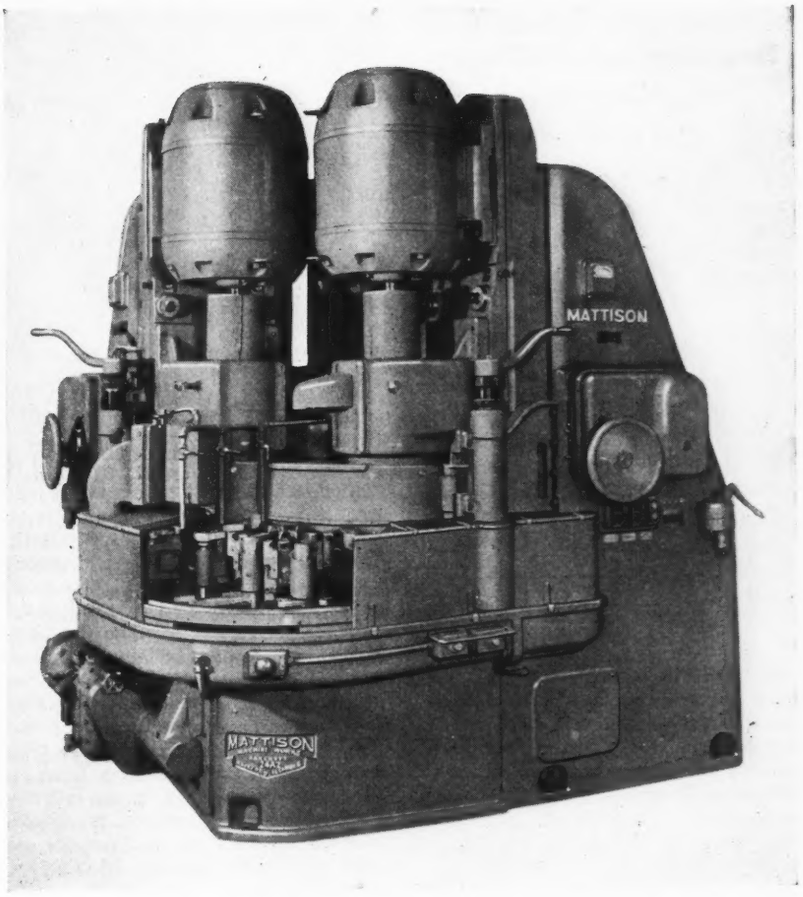
(Left) Views illustrating shaft misalignment conditions under which new Ajax "dihedral" coupling can be operated. (Right) Cutaway view showing internal construction of new "dihedral" coupling

To obtain additional information on equipment described here, use Inquiry Card on page 225.

Mattison Automatic Rotary Surface Grinder

The Mattison Machine Works, Rockford, Ill., has built a two-spindle automatic rotary surface grinder with a special fixture for grinding the sides of connecting-rods. This machine, designated No. 24A2, is arranged to first rough-grind the connecting-rods with a coarse-grained wheel mounted on the first of two spindles, after which the rods are checked by an automatic sizer. The rods then pass under a fine-grained wheel mounted on the second spindle for the finish cut. The work is again checked at this point by an automatic sizer before being released from the fixture.

This machine has a work-table 36 inches in diameter with a variable speed range of 3/4 to 2 1/4 R.P.M. The spindles are mounted in precision preloaded ball bearings. Each spindle is operated at a speed of 900 R.P.M. by a 25-H.P. motor. The machine can be equipped with cylinder type wheels 18 by 4 by 14 inches or segmental wheels 18 by 6 by 15 inches. 75



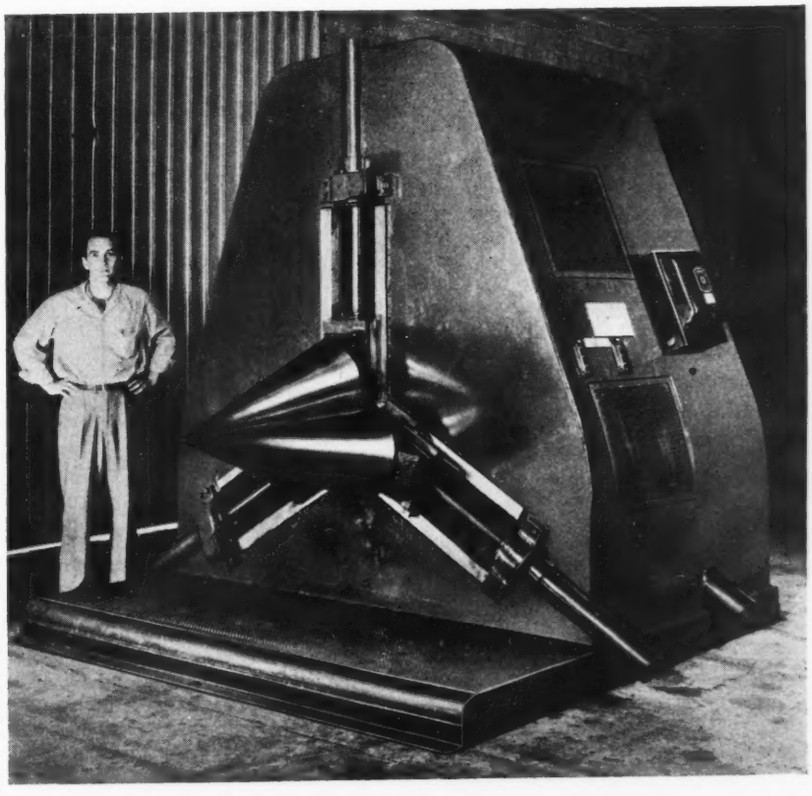
Mattison automatic rotary surface grinder with special fixture developed for grinding sides of connecting-rods

Reed Cone-Rolling Machine

The Reed Engineering Co., Carthage, Mo., has recently brought out a cone-rolling machine which is being used in jet-engine production work. This machine is designed to roll sheet-metal pieces into cones or conical shapes. It has three conical-shaped rollers mounted in a cantilever arrangement and will produce cones with almost completely formed points at their small ends.

Each of the three rolls is driven by an independent motor, and each roll is also adjusted independently by a separate motor. The rolls can be set for any position from full parallel up to a 45-degree included angle. The actual forming rolls are of the interchangeable type, and can be readily removed and replaced from the front of the machine.

One set of forming rolls normally handles a wide range of cone-forming jobs, although for high-production work and extreme accuracy, individual rolls are recommended for each type of cone produced. The machine is about 8 by 8 by 8 feet in size, and weighs 13,000 pounds. 76

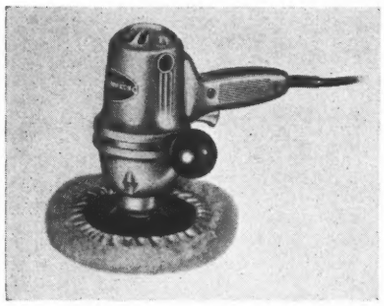


Reed machine for rolling sheet-metal pieces into conical shapes

To obtain additional information on equipment described here, use Inquiry Card on page 225.

Cummins Portable Brushing and Polishing Machine

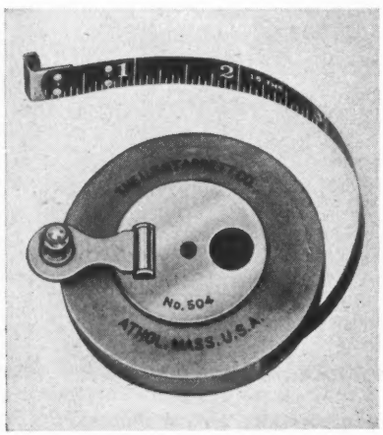
Portable 6-inch cleaner-polisher weighing only 4 1/4 pounds, which operates at a no-load speed of 1300 R.P.M. and has sufficient reserve power for a wide range of sanding, drilling, grinding, wire-brushing, buffing, and rubbing operations. Will drill up to 1/4-inch

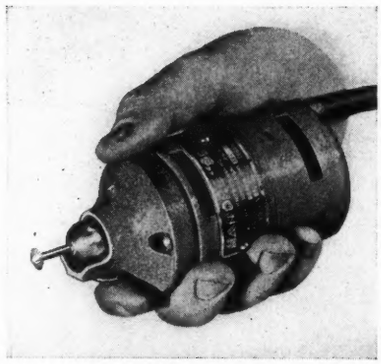


holes in metal and 1/2-inch holes in wood; and when equipped with carbide-tipped drills will drill holes up to 3/8 inch in stone, tile, concrete, etc. Announced by Cummins Portable Tools, Division of Cummins Business Machines Corporation, Chicago, Ill. 77

Starrett Steel Measuring Tape Line

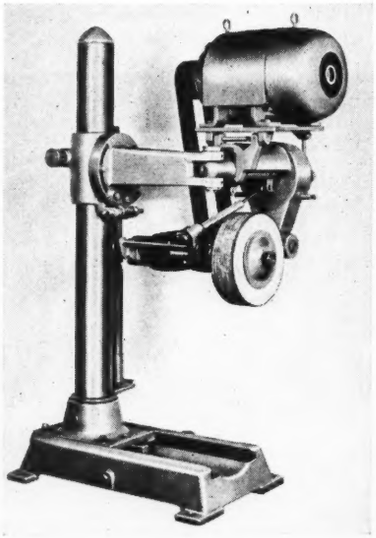
"One-man" steel tape measuring line with a hook riveted to the end which enables workmen in steel mills, warehouses, etc., to measure metal sheets readily without assistance. Graduations start from the inner side of the hook and are marked with consecutive inches, in 1/16 divisions, from 1 to 144 or 1 to 240, depending on the tape length. The bright steel graduations are etched on one side of the tape on a black background. The case is made of steel to withstand hard usage, and has a heavy nickel-plated satin finish. Deep knurling around the complete diameter provides a "sure grip" holding surface. 78





Hand Power Tool for Precision Work

"Handee 85" hand power tool suited for use on industrial production lines, as well as for fine handicraft work. This tool is nicely balanced and shaped to fit the hand. It has an idling speed of 27,000 R.P.M. and a speed under load of 20,000 R.P.M. The weight is 2 pounds. Spring collets of 1/16-, 3/32-, and 1/8-inch capacity can be accommodated. The new chuck construction assures smooth running action, with a quick firm grip on tools or accessories. The cooling arrangement permits the tool to run all day without excessive heating. Many different accessories are available for use with this tool. Product of Chicago Wheel & Mfg. Co., Chicago, Ill. 79

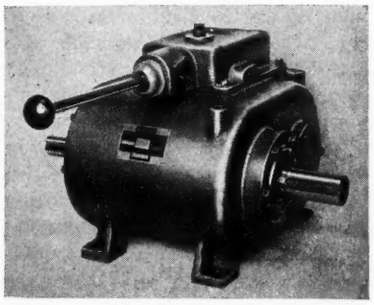


Murray Polishing Heads

Universal polishing or buffing head designed to meet the need for a compact, low-cost, versatile head. These units, known as the 60 series, will be available in two standard sizes—No. 61 rated at 10 to 15 H.P., and No. 62 rated at 5 to 7 1/2 H.P. Both units will be of substantially the same design. Special pneumatic controls automatically assure constant, accurate work pressure. Made by the Murray-Way Corporation, Detroit, Mich. 80

Western Transmission

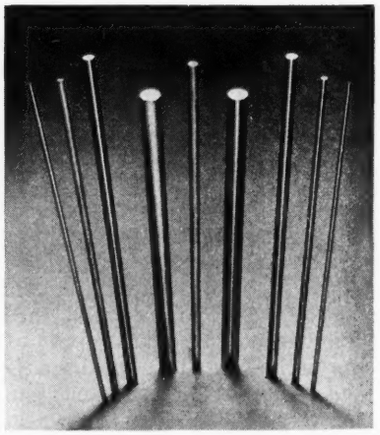
New design Model 420 transmission of 20 H.P. capacity with input speed of 900 R.P.M. announced by Western Mfg. Co., Detroit, Mich. The four speed changes of this transmission are in geometric progression of 1.7 to 1 with a 5 to 1 over-all ratio. The transmission case is large enough to accommodate gears for special ratios up to 9 to 1. All gears and shafts are of



heat-treated alloy steel, and the gears are shaved. Revolving shafts are mounted in anti-friction bearings, and the case is oil-sealed. 81

Sylvania Pure Tungsten Electrodes

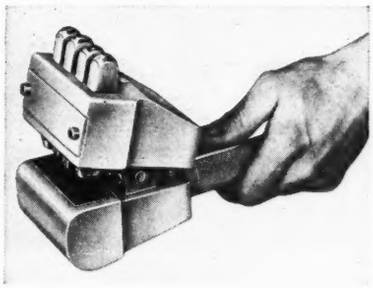
Pure tungsten electrodes having a melting point of about 6000 degrees F., suitable for atomic-hydrogen, helium, and argon gas-shielded electric arc-welding can be used in welding aluminum, beryllium copper, brass, copper, copper to stainless steel, lead, magnesium, molybdenum, Monel metal, nickel alloys, phosphor bronze, stainless steels, tantalum, and tungsten. The new electrodes are available in any diameter and length, although the most generally used sizes range from 0.040 to 0.250 inch in diameter and are from 3 to 18 inches in length. They are supplied with chemically cleaned and etched finish or centerless-ground finish for collet feed on automatic equipment. Announced by Tungsten and Chemical Division of Sylvania Electric Products, Inc., Towanda, Pa. 82



To obtain additional information on equipment described here, use Inquiry Card on page 225.

Marking Device for Stamping Sheet Material

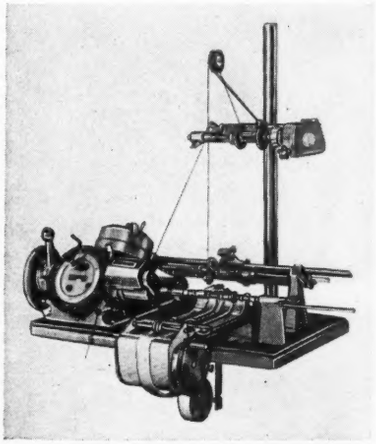
New marking device for stamping steel sheet, strip, and other flat thin metals announced by M. E. Cunninham Co., Pittsburgh, Pa. Made from aluminum for light weight and ease in handling, with a holder section that accommodates almost any size or number of characters. The top swivels upward under finger pressure, so the holder can

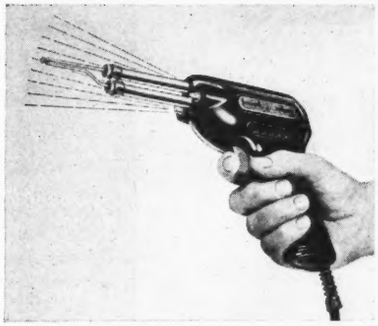


be slipped over the pieces to be marked. When pressure is released, the top drops into position for marking, which is accomplished by striking each stamp with a light-weight hammer. 83

Fine-Wire Coil Winding Machines

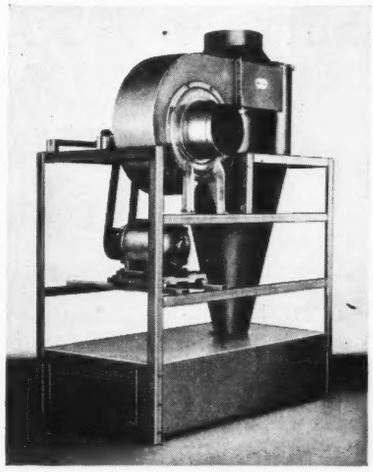
Micafil fine-wire coil winding machine with automatic paper interleaving attachment now being marketed by the Cosa Corporation, New York City. This model handles wires from 24 to 48 AWG (without insulation) when guided automatically, and wires up to 15 AWG (without insulation) when guided by hand. It will wind coils up to 3 1/8 inches coil diameter and from 5/8 inch to 3 3/4 inches wide. The paper interleaving attachment automatically lengthens the paper strip as the coil diameter increases. Paper in widths from 3/4 inch to 4 inches and in lengths from 3 1/2 to 10 inches can be handled. Wire breakage or empty reel operates automatic cut-off. 84





Dual-Spotlight Soldering Gun

Dual spotlights, positioned to eliminate shadows, and terminals located in over cnd under positions to brace tip and improve visibility are features of this light-duty soldering gun recently announced by the Weller Electric Corporation, Easton, Pa. The new model is considerably smaller and lighter than previous 135-watt guns, yet it has substantially greater soldering capacity. Features include dual heat—100 to 135 watts—for all light and delicate soldering work; five-second heating to save time and current; trigger switch control, which adjusts heat to the work and eliminates the need of unplugging gun between jobs; and chisel shape "Wellertip," designed to provide faster heat transfer and permit speedier soldering.....85

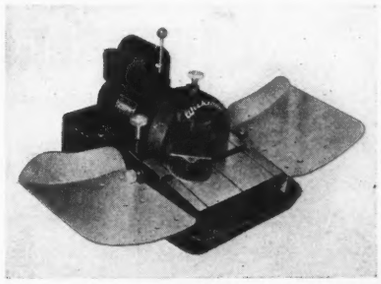


"Dustkop" Dust Collector

"Dustkop" dust collector available as a pre-tested unit from the Aget-Detroit Co., Ann Arbor, Mich. Designed to separate industrial dusts from the air stream and discharge toxic fumes out of doors. Develops a capacity of 10,050 cubic feet per minute with a 15-H.P. motor. The unit is recommended for handling practically any type of industrial dusts, such as are produced by buffing, polishing, and woodworking operations, as well as the handling of chemicals, foodstuffs, etc. 86

Wickman Bench Grinding and Lapping Machine

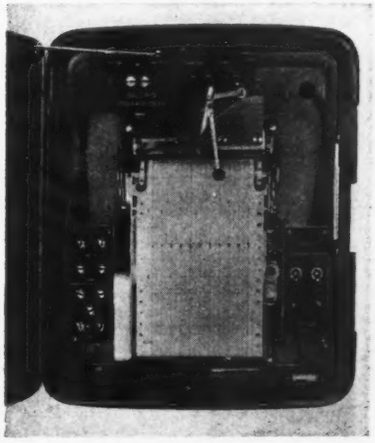
New model motor-driven bench grinding and lapping machine in which silicon - carbide and diamond abrasive wheels can be used. Announced by the Wickman Mfg. Co., Detroit, Mich. The improved GF-2A model is provided with a second wheel guard for use with ordinary abrasive wheels, a three-position table to provide for wheel



wear, a milled protractor slot, and a new coolant filter. The wider wheel guard has splash protectors. 87

Baldwin Strain Recorder

Strip-chart strain recorder for continuous measurement of surface strain in structures or machines by means of SR-4 resistance wire strain gages. Announced by the Baldwin Locomotive Works, Philadelphia, Pa. This electronic type instrument is designed and calibrated for use with two SR-4 gages having a resistance of 120 ± 1.2 ohms and a sensitivity factor between 1.9 and 2.2. Usually one gage is active and the other is used for temperature compensation, but both may be active for measuring combined bending and tensile stresses or differential strains. The available ranges are 0 to 2000, 0 to 5000, and 0 to 10,000 micro-inches per inch. Ten chart speeds are provided in a range of 3/4 inch to 720 inches per hour. The pen moves across a 4 1/2-inch wide chart in a straight line, thus simplifying the making of



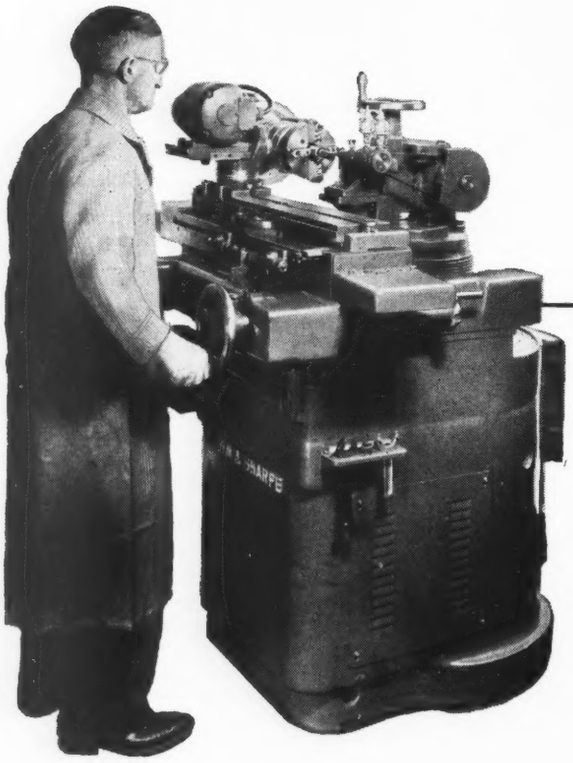
A New Machine

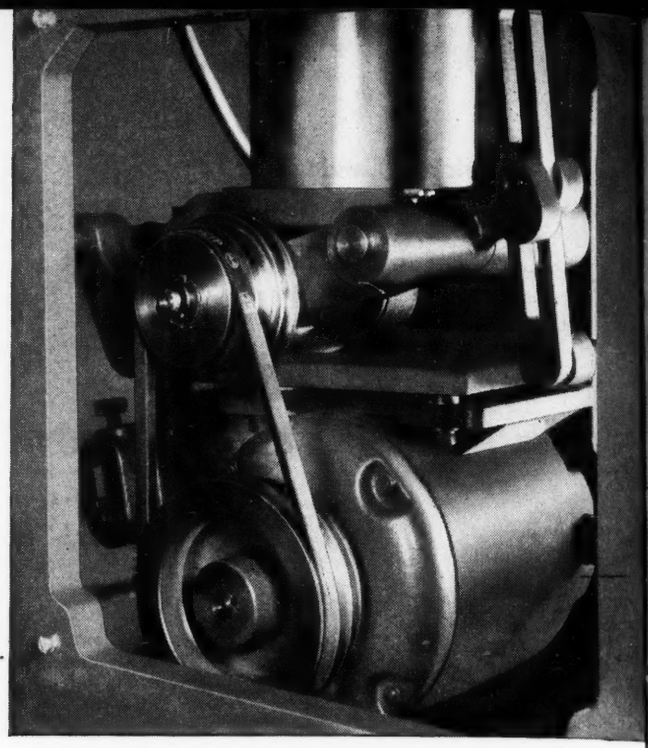
with

UNIVERSAL

or Plain

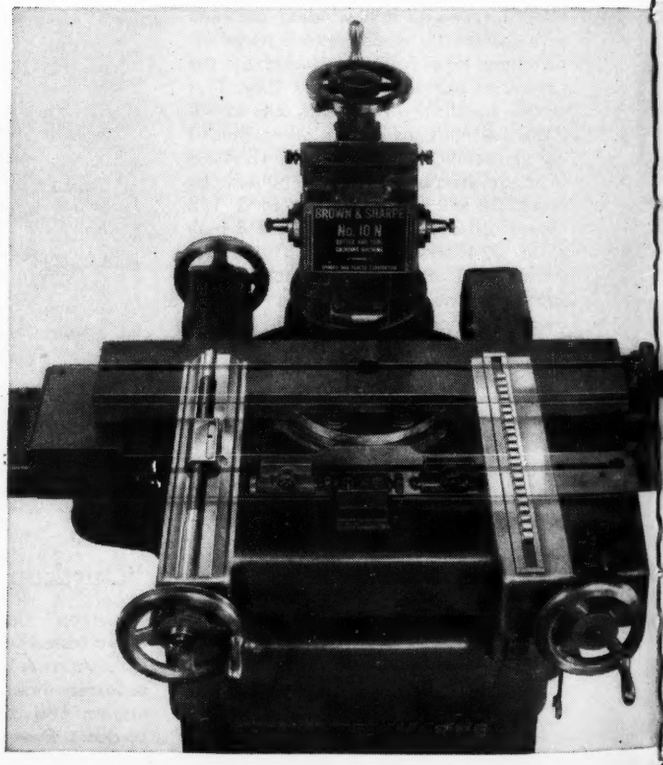
Equipment





Three rates of spindle speed provided by stepped sheaves and V belt shown here. ¾ H.P. motor and mechanism are mounted on lower end of spindle column in base of machine.

Smooth, non-cramping carriage movement is assured by precision-ground rollers on flat way together with cross feed screw located directly above V-way.

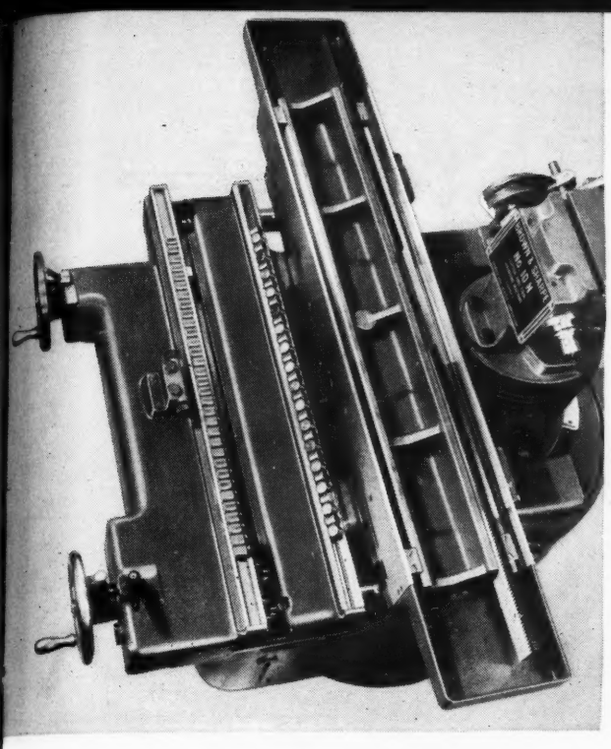


The New No. 10N

Cutter and Tool

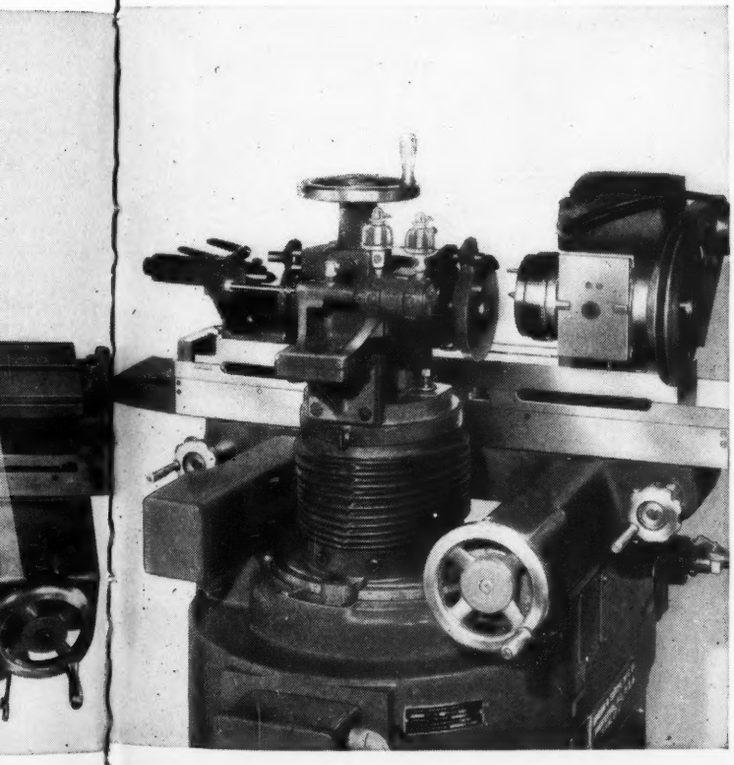
Grinding Machine

BROWN &



Easy, accurate table movement is made possible by this unique arrangement of precision-ground rolls.

Conveniently placed controls make operation of machine equally easy from front-of-table, right-rear-of-table (as illustrated) or left-rear-of-table.



Back up better PRODUCTION equipment with this modern TOOLROOM equipment

If faster production through the use of modern production machines is putting a heavier burden on your toolroom, here's a new way to offset it. The super-versatile No. 10 N Cutter & Tool Grinding Machine with Universal Equipment is especially designed for rapid, accurate cutter sharpening and miscellaneous toolroom work.

UNIVERSAL EQUIPMENT gives broad use

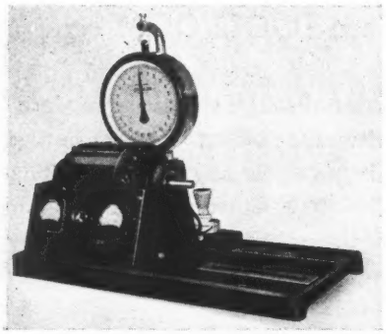
Where toolroom grinding involves a wide variety of jobs — light external and internal cylindrical grinding, surface grinding, etc., as well as routine sharpening — the No. 10 N with Universal Equipment offers unmatched advantages . . . a money-saver on either toolroom or production work. It includes — revolving spindle headstock equipment, internal grinding fixture, formed cutter sharpening attachment (in-feed type) and a surface grinding vise. Where toolroom grinding involves only tool and cutter sharpening, the No. 10 N with Plain Equipment may completely meet the demands of your modern production machines. The same, simple, basic design is common to both.

Designed to Save Waste Motion

Notice the following Brown & Sharpe features that mean so much to operating efficiency . . . handwheels conveniently located for fast, easy operation . . . elevating handwheel of wheel spindle is at convenient eye level . . . internal grinding fixture may be left permanently mounted (does not interfere with cylindrical or cutter grinding). These and other important features, including useful attachments, are fully described in a NEW BULLETIN. Send for your copy. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE B·S

coordinated readings of time versus strain. The instruments are available with full-scale traverse speeds of one, three, or five seconds. 88

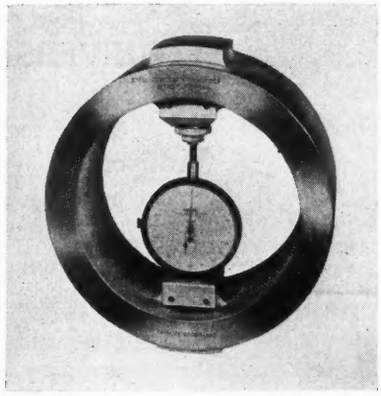


G-E Fractional-Horsepower Dynamometer

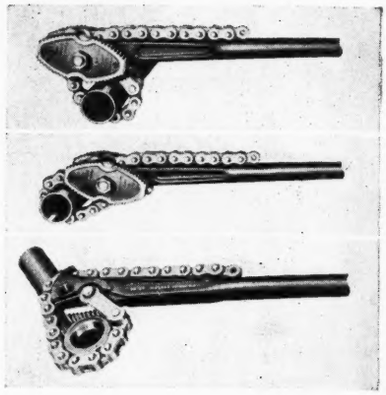
Fractional-horsepower dynamometer of improved design developed for small machine and appliance manufacturers by the General Electric Co., Schenectady, N. Y. This instrument is designed to aid in analyzing and demonstrating the operation of fractional-horsepower motors, generators, and other dynamometers. It also permits the testing of internal combustion engines and mechanical equipment within its capacity rating. Has a continuous absorption or motoring rating of 3/4 H.P. at 2000 R.P.M. Maximum safe speed is 4000 R.P.M. The 10-inch diameter dynamometer scale is graduated in pounds with 0.1 pound subdivisions. 89

Proving Rings for Calibrating Load on Testing Machines

Proving ring for calibrating the load on various types of testing machines, including Brinell and universal machines. These rings are of the direct reading type, whereby deflection of the ring under load is accurately measured by a dial indicator graduated to 0.0001 inch. The readings are translated into pounds by a calibration chart furnished with the ring. Two standard styles are available—an oval shape used for capacities up to 20,000 pounds and a round shape for capacities of 20,000

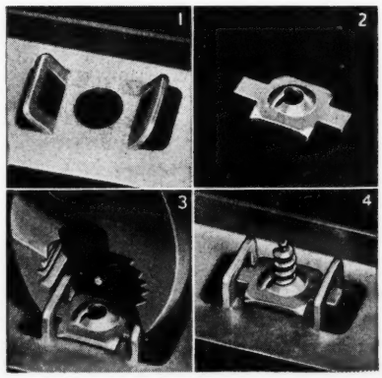


pounds up to 110,000 pounds. All rings conform to A.S.T.M. standard E4 and are chromium-plated. Brought out by Steel City Testing Machines, Inc., Detroit, Mich. 90



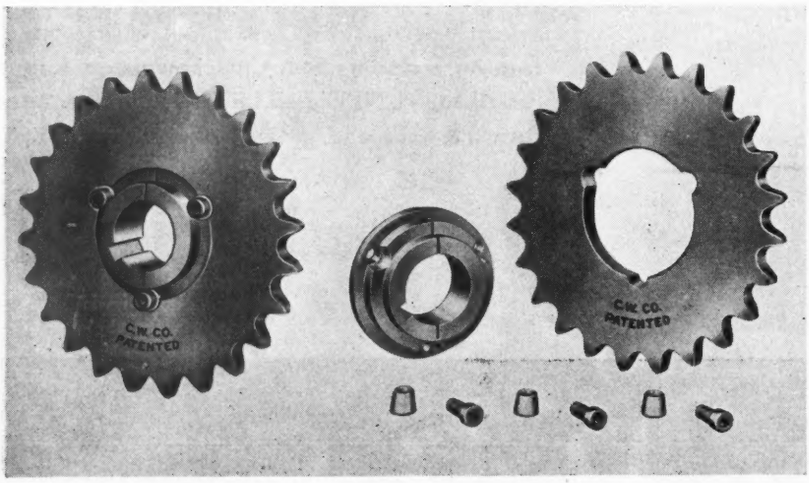
Reversible Pipe Tongs

"Vulcan" reversible pipe tongs, which can be used to turn pipe in either direction without removing the tongs or loosening the chain. Since removal of the tongs is unnecessary, no time is lost in reversing the direction of rotation. The outer jaws can be removed, as shown in the lower view, to adapt the tongs for installing or removing fittings having narrow beads and flanges. Jaw removal is accomplished by taking out a single bolt and nut. The outer jaws are also reversible, end for end, thus doubling their useful life. Available from J. H. Williams & Co., Buffalo, N. Y., in four sizes from 1/4 inch to 8 inches. 92



Cullman "Grip-Master" Interchangeable Hubs for Disk Sprockets

Assembled and disassembled views of "Grip-Master" interchangeable hub for disk sprockets, introduced by the Cullman Wheel Co., Chicago, Ill. The sprocket plate is placed on the hub, as shown at the left, the taper bushings inserted, and the cap-screws tightened to complete the assembly, ready for mounting on the shaft. Frequently plate sprockets can be interchanged and mounted without removing the hub from the shaft. The disk sprockets and interchangeable hubs are made in a wide range of sizes. 91



Prestole "Floating" Nut

Successive steps in applying a "cage" type "floating" nut for fastening sheet-metal parts. The new type nut does not require a loose cage, but utilizes a cage punched in the sheet metal itself. The floating nut is located in place by merely dropping it over two pre-punched loops which are quickly pulled up with ordinary pliers in the manner shown in the upper left-hand view. This method saves a great amount of metal and eliminates the necessity of handling separate cages, as well as the need for spot-welding. The manufacturer's patented conical-shaped impression is formed in the nut to provide a 360-degree helical thread-grip on the screw thread. Product of Prestole Corporation, Toledo, Ohio. ..93

To obtain additional information on equipment described here, use Inquiry Card on page 225.

Get this SHAPER CATALOG

Here is the latest information on low cost machining. This 32-page, heavily illustrated catalog contains complete specifications and features of Cincinnati Shapers. Many practical and useful shop applications are illustrated. Cincinnati Shapers give you maximum versatility with minimum investment and minimum tooling cost. Write for your copy.

THE CINCINNATI SHAPER CO.

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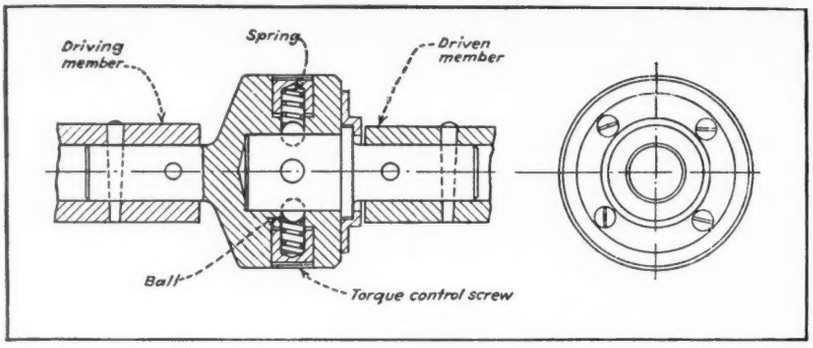
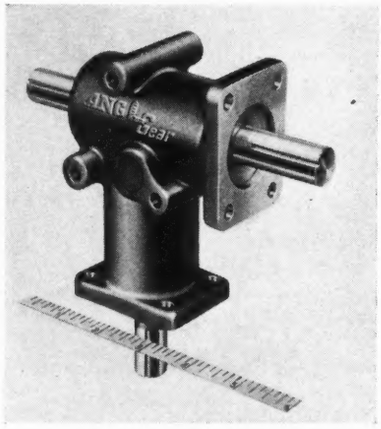


Torque Overload Control

Shaft coupling designed to protect driving or driven members from damage caused by overloads and sudden interference with normal operation. This device is of simple design, and can be easily adjusted by the torque control screws to the exact specified torque desired. If necessary, it can be set to disengage at a torque load as low as 1 inch-pound, as well as to carry any desired load within its capacity. Its small size permits easy application between driving and driven members. Typical applications include speed reducers, flexible cable drives, and motor-operated valves, as well as any type of motor-driven equipment. Various models are available to suit mounting needs. Made by Overload Control Co., Glen Oaks, Long Island, N. Y. 94

Wide-Field Binocular Microscope

Special wide-field binocular microscope with an attachment to simplify such operations as counting finely spaced lines or the threads in fabrics. Three templets with 1/4-, 1/2-, and 1-inch square openings are furnished. A pointer or indicating finger attached to a precision slide can be moved along from line to line to avoid errors. Two types of microscopes are available—Model A with two pairs of interchangeable eye-pieces giving total magnifications of 4 1/4× and 6 1/2×; and Model B with three pairs of eye-pieces producing 10X, 20X, and 30X magnifications. Placed on market by George Scherr Co., New York City. 95

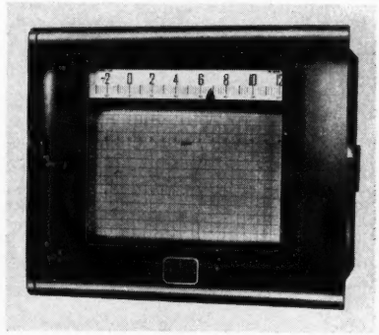


Angle Gear Drive

Angle gear drive of 1 H.P. capacity for use in either manual or power-operating systems. This unit has been production tested and rated at 750 inch-pounds static torque. It is made with shaft diameters of 5/8 inch. Special units with shaft extensions can be furnished to order. Two models, R-320 and R-330, are available in either two-way or three-way units with a standard 1 to 1 gear ratio and a 2 to 1 reduction as an optional feature. Brought out by Airborne Accessories Corporation, Hillside, N. J. 96

Bristol Strip-Chart Electronic Instruments

Strip-chart "Dynamaster" electronic instrument recently announced by the Bristol Co., Waterbury, Conn. This Series 500 high-speed, self-balancing alternating-current bridge instrument is designed for measuring temperature, resistance, conductivity, strain, position, inductance, pressure, force, or any other variable that can be measured in terms of impedance. In addition, the instrument can be used for electric power totalization and as a receiver for the Bristol "Metameter" system of "Telemetering." The measured variable is recorded on a chart 11 1/4 inches wide and indicated on a large scale, which is legible at a distance. In addition to the single-record model, instruments are available for making as many as sixteen different records on the same chart. Supplementing the



recording instruments is a complete line of strip-chart "Dynamaster" automatic controllers, including electrically and pneumatically operated types. ..97

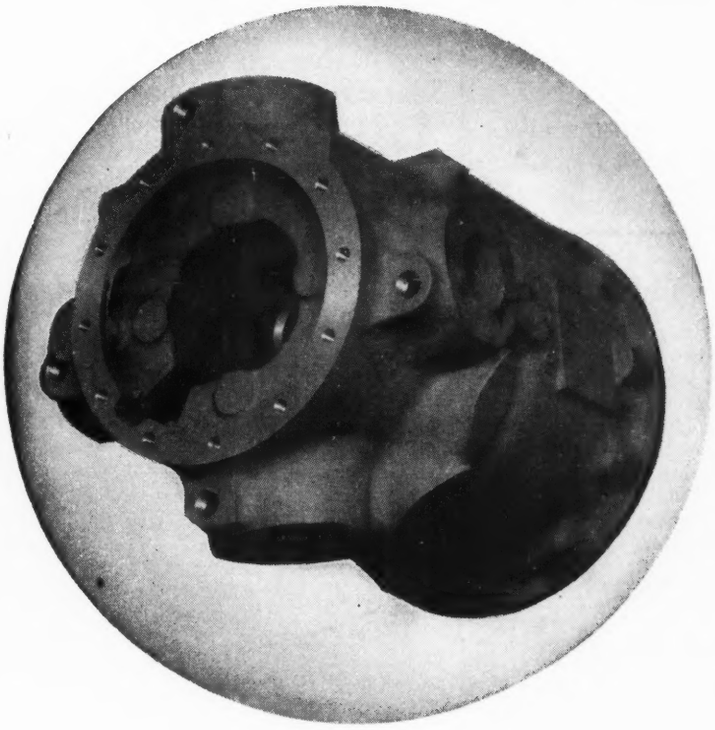
"Flo-Set" Control Valve

"Flo-Set" valve with micrometer graduations for precision speed control of low-pressure cylinders. Graduations are in hundredths of a revolution with each hundredth representing 1/100 of the

pipe area. Available in 1/4-, 3/8-, and 1/2-inch sizes. The complete line of control valves also includes the 1/4-inch Junior valve, which is specifically designed for use with tubing. The latter valve functions the same as the larger sizes, but does not have the micrometer adjustments. These valves

To obtain additional information on equipment described here, use Inquiry Card on page 225.

One a minute-

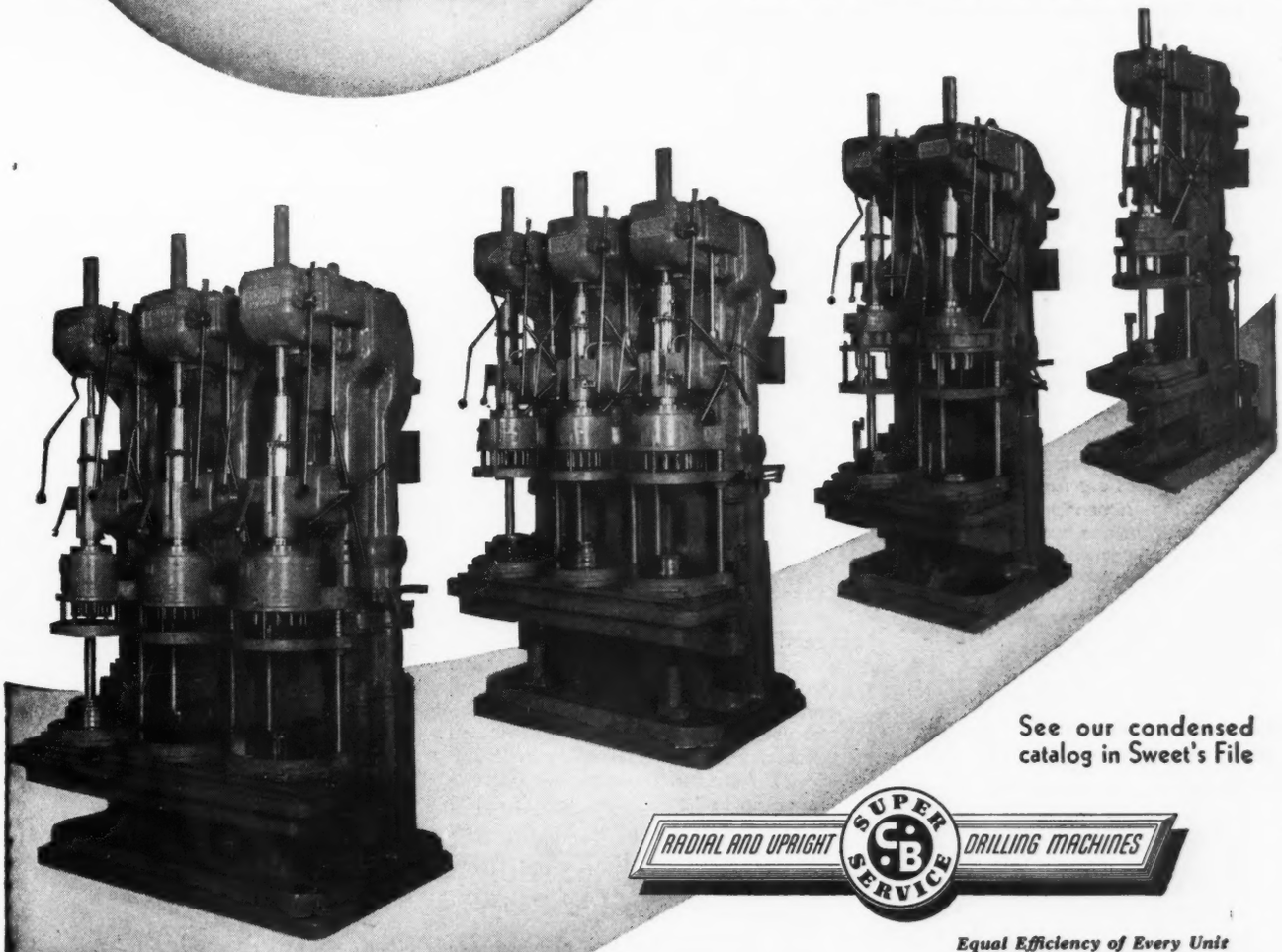


This battery of highly productive 21" and 24" Cincinnati Bickford Super Service Direct Drive Drills is drilling 24—.257" holes; tapping 24—$\frac{5}{16}$" holes; step drilling 4—$\frac{13}{32}$" x $\frac{7}{16}$" diameter holes $1\frac{5}{8}$" deep; tapping 4—$\frac{5}{8}$" holes in this crank case housing.

The operations are performed on both ends of three sizes of castings. All operations are completed at the rate of one a minute.

These Direct Drive Drilling Machines are made in the following sizes: 21" with 3 or 4 horsepower motor; 24" with 5 or $7\frac{1}{2}$ horsepower motor; 28" with $7\frac{1}{2}$ or 10 horsepower motor.

Write for Booklet U-27 for complete description.



See our condensed catalog in Sweet's File

RADIAL AND UPRIGHT SUPER C B SERVICE DRILLING MACHINES

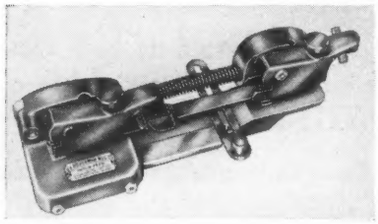
Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

are suitable for air, water, or oil control at pressures up to 250 pounds per square inch and temperatures up to 250 degrees F. They can be mounted in any position. Announced by Hanna Engineering Works, Chicago, Ill. 98

Coiled Stock Hitch Feed

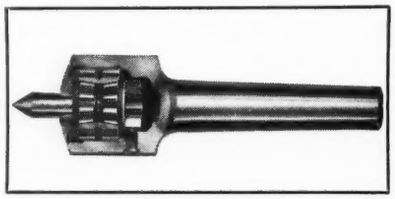
New 2 1/2-inch hitch feed for handling the lighter gages of stock ranging from 0.003 to 0.050 inch in thickness with accurate control and without buckling. This feed is designed to be easily mounted on any press or die set. It will



handle the feeding of stock to intricate multi-station progressive dies, as well as simple blanking and piercing dies. No tools are required to make adjustments for gripping pressure or feed length, and the design automatically maintains the proper gripper - plate angle. Announced by the H. E. Dickerman Mfg. Co., Springfield, Mass. 99

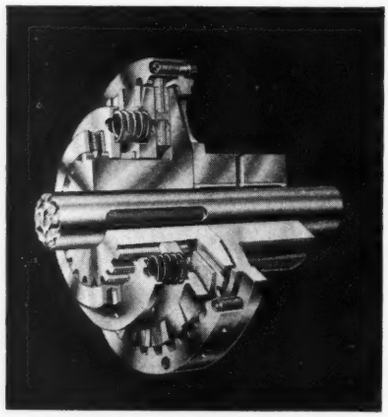
Hannifin Large-Diameter Cylinders

One of a line of completely redesigned 14- and 16-inch low-pressure cylinders for 125 pounds per square inch air operation or 160 pounds per square inch hydraulic operation. Announced by the Hannifin Corporation, Chicago, Ill. These new cylinders have cup type pistons and chevron type gland packings, and are available in a wide range of mounting styles. The compact, rugged end caps are furnished in the same mounting dimensions and in either cushioned or non-cushioned styles. Two large pipe ports are drilled in each cap, the 14-inch bore size having 1-inch tapped ports and the 16-inch size 1 1/4-inch ports. Double-end rods are available in most mounting styles. The 16-inch cylinder exerts a force of 10 tons at an operating pressure of 100 pounds per square inch. 100



Arrow Live Center

Live center equipped with precision Timken roller bearings and designed to accommodate interchangeable tapered inserts. Simple adjustment for wear is provided through a screw. Double-cone, single-cup type bearings provide sufficient bearing surface for both thrust and radial loads. The tapered inserts, of both male and female types, are available in Nos. 1, 2, 3, 4, and 5 Morse taper sizes. Made by Arrow Tool & Reamer Co., Detroit, Mich. 101

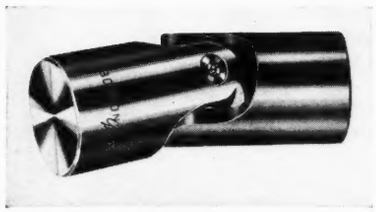


Constant-Torque Slip Clutch for Winding Operations

Slip clutch designed by the Hilliard Corporation, Elmira, N. Y., to help solve the problem of maintaining constant tension or constant torque in winding operations performed in the wire, plastics, printing, papermaking, and textile industries. Also designed to be used as a safety device for overload protection. Made in sizes from 2 3/8 to 27 inches in diameter, with torque range up to 10,000 foot-pounds. ..102

Universal Joint with Interchangeable Parts

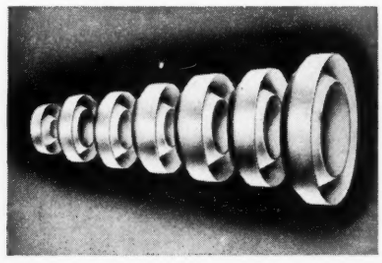
Universal joint with interchangeable parts now being manufactured by Boston Gear Works, Quincy, Mass. Designed for high load carrying capacity



and high static torque rating to meet government specifications. A self-locking assembly ring provides secure assembly and permits quick and easy disassembly and reassembly. Lubricated by self-closing ball-valve oiler. 103

Frictionless Chemically Inert V-Ring Packing

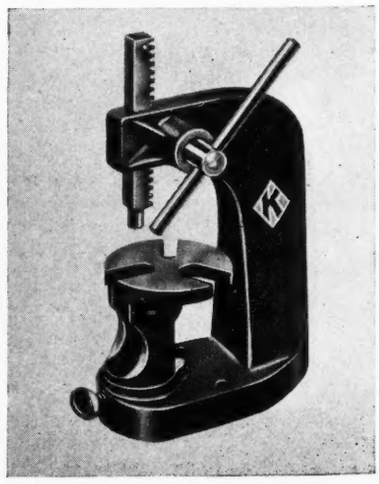
"Schemlon" V-rings molded from pure Teflon, brought out by the Crane Packing Co., Chicago, Ill. These packing



rings are said to be practically frictionless and to cause no wear on hydraulic valves. Being chemically inert, they are not affected by corrosive solutions. They are said to withstand temperctures up to 450 degrees F., and even at varying operating pressures to remain tough and resilient and to maintain a permanent seal with only fingertip pressure on the gland. 104

Small Size Arbor Press

Small size hand-operated arbor press made by H. D. Herder—Tool Specialties, Kalamazoo, Mich. This HP-600



To obtain additional information on equipment described here, use Inquiry Card on page 225.

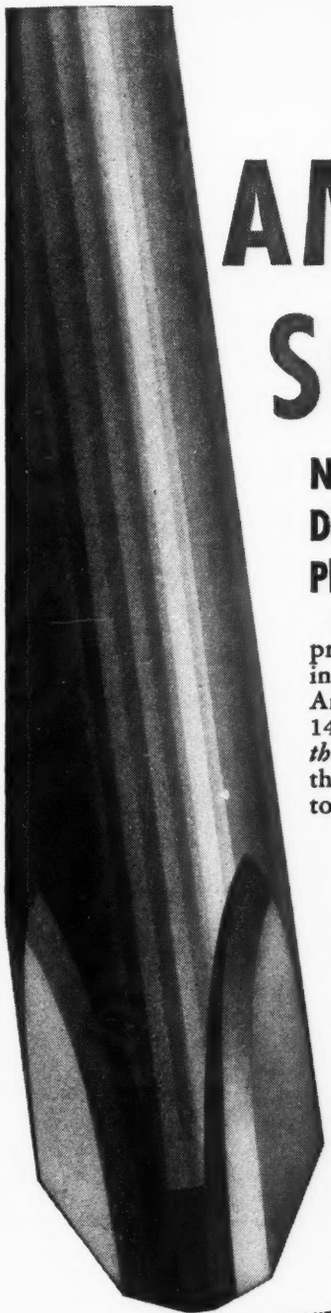
New Driving Power Behind AMERICAN PHILLIPS SCREWS!

New Campaign Goes Direct to Retail Buyers of Phillips-fastened products

Manufacturers of all types of products know the production-savings and sales-promotion power of American Phillips Screws. And now 14,000,000 prospective *buyers of those products* are being introduced, through the Saturday Evening Post, to the dependable "buy sign" of the Phillips Crossed Recess (the recess with the wide center opening for easy driving). They are being told that:

✖ is a *Known Quality*... a mark of *Top Quality* throughout the product

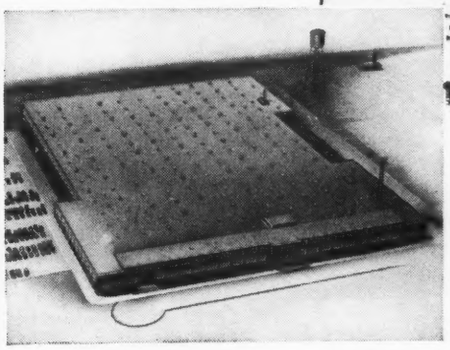
This campaign puts greater sales drive than ever behind American Phillips Screws... another good reason why it's good business to Phillips-fasten *your* products.



4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

THE SATURDAY EVENING POST

PHILLIPS HEADquarters is this new and modern 5-acre plant at Willimantic, Conn., where American is in stronger position than ever to supply the growing demand for Phillips fasteners.



Can you find the clue...
...to quality? ✖ marks the spot...
Yes! a PHILLIPS SCREW
There's no mystery to quality when you know what clue to look for. Phillips Cross-Recessed-Head Screws are proud of extra care in today's manufacture. They assure lasting, creep-free tightness at all points of fastening. Be on the lookout for Phillips Screws . . . used on everything from streamlined cars to modern bearing aids.
PHILLIPS Cross-Recessed-Head SCREWS
on sale at hardware, automotive and mill supply outlets

AMERICAN SCREW COMPANY

Plants at:
WILLIMANTIC, CONN. and NORRISTOWN, PA.
Warehouses at:
589 E. ILLINOIS ST. CHICAGO 11
502 STEPHENSON BLDG. DETROIT 2

arbor press is especially adapted for use by model makers, jewelers, instrument makers, radio men, research workers, etc. Also is suitable for handling light high-speed production and assembly work requiring pressures up to 800 pounds. The table is 3 inches in diameter, and has three slots for arbor work, 1/4, 1/2, and 3/4 inch wide. The table and table standard can be removed to accommodate large work. A straightening attachment with V-supports spaced 4 1/2 inches apart is available. The frame is 7 3/4 inches high, and the travel of the 1/2-inch square ram is 2 5/8 inches. The weight is 10 pounds. 105

Schrader Air-Line Filter

Filter designed to be placed in air line ahead of air control mechanism or air-operated tools to protect them by removing rust, dirt, and moisture from the line. The filtering element, composed of hundreds of laminations of a fine, newly developed material, is large enough to assure full air flow even after long periods of use. Moisture that is trapped can be removed through a handy drain cock. This filter is available in 1/4-, 3/8-, and 1/2-inch standard pipe sizes. Pipe connections are of the straight-in-line type. 106

Circular Slide-Rule for Adding and Subtracting Fractions

A circular type scale device for quickly adding or subtracting fractions, in units of one sixty-fourths inch, has recently been made available. This device, known as the "Fractionator," is approximately 6 inches in diameter. It consists of three disks; the scale on the outer disk shows fractions in 1/32-inch increments; the inner disk indicates fractions in 1/64-inch increments; the center disk revolves, and is dialed with a pencil point, like a dial telephone.

The method of using the device is as follows: To add the fractions, for example, 3/16, 5/32, 9/64, and 1/4, dial the center disk clockwise, as you would a telephone number, using the designated fractions shown in the upper portion on the inner and outer disks. The answer automatically appears in the answer slot, together with its decimal equivalent.

Device for quickly adding and subtracting fractions

To subtract, for example, 1/4, 3/64, and 9/32 from this figure, dial the disk counter-clockwise, using the designated fractions appearing in the lower half of the circle. In addition to adding and subtracting fractions, the "Fractionator" converts fractions to the decimal equivalents, as mentioned. Further information can be obtained from the inventor, Charles E. Wells, P. O. Box 25, Montrose, Calif.

* * *

Safety Booklets for Foremen and Supervisors

Six new training booklets for foremen and supervisors, called "The Psychology of Safety in Supervision," have just been issued by the National Safety Council. The series is written by Dr. J. L. Rosenstein, industrial psychologist and professor in the department of management, Loyola University, Chicago, Ill. Among the subjects discussed are the common peculiarities of human nature; the importance of a supervisor's ability to understand the attitudes and actions of his workers; accidents that happened because workers lacked sufficient knowledge or skill, and supervisory training methods required to prevent such accidents; basic human wants and how supervisors can satisfy these wants; methods for supervisors to make safety interesting and important to workers; and how supervisors can evaluate their own habits, emotional biases, and abilities as supervisors.

Complete sets of the six booklets are offered to members of the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., at 90 cents per set, in quantities of from one to nine, and at lower prices for larger quantities. The prices to non-members are double those to members.

* * *

According to the American Gear Manufacturers Association, the volume of business in the gearing industry, as reported by members of the Association, increased by 50.3 per cent in August, compared with the previous month. The index figure for August, 1950, is computed to be 617.4 (1935-39 = 100).

By E. S. Salichs

BETWEEN GRINDS

Stomping Ground

The same day's mail brought us two curious inquiries: One man wanted the name of a manufacturer of cardboard for accordion bellows, 30 gage. The other, a new home owner in a locality where there is no garbage collection, wanted an electric dehydrator and grinder. The grinder, it was specifically stated, was to be capable of handling small bones from the table, and the grindings, destined as fertilizer, were to be the size of percolator coffee. We were inclined to refer the two correspondents to each other, as we visualized evenings of pungent melody wafting over the countryside.

A Book and Its Cover are Often Parted

A Norwegian subscriber wanted information on plastic coatings used on the cover of pocket edition books and sent us a sample cover of a Ponni-Bok depicting a Woolly West scene of a shooting taking place outside of swinging barroom doors. We referred him to several companies who use a laminating process which makes the cellophane adhere to the paper cover. Title on the cover was "I Sadlen Igjen," which translated is probably "In the Saddle Again." That Destry gets around!

Pay on a Tray

If you take out a subscription to MACHINERY in Italy, you shake out 4940 lire (the equivalent of $7) from your pantaloni and walk off with a lighter step.

Garages in Clover — Push on Walls Over

All the suburbanites who in recent years eked out an extra foot or two for their garages by poking out the back or extending the front, and those who merely treated their cars to the ferry slip treatment (bump right, left and front) may breathe more easily now. Harley J. Earl, design authority and GM vice-president in charge of the styling section, says maximum width and length of America's automobiles have been reached, and the tendency now is to reduce length by better space utilization.

Rubber Gives More

Pound for pound, rubber goes farther today than it did ten years ago, says Harold Gray, B. F. Goodrich technical superintendent. Rubber products still take as much rubber as they used to but research and development have lengthened their service life. For instance, this year's passenger tires are giving American drivers from 15 to 25 per cent more tread mileage than in 1940. Well, rubber isn't the only elastic industry—we could stretch out this story too.

The Makings of a Party

One of our subscribers, Lubbers & Bell Mfg. Co., Clinton, Iowa, manufactures metal chair seats, fly swatters, and games. One thing just naturally led to another.

BENDING EXPERT—Ralph M. Shaw, Jr., hailing from Chicago, is president of the Pedrick Tool & Machine Co. of Philadelphia, and a registered professional engineer in the state of Pennsylvania. His boyhood was spent as an invalid due to an illness, and his education undertaken at home. When fifteen years old, he entered high school, fast condensing a four-year course in two years. Matriculating at Yale, he graduated with his class in 1919, despite the fact that he took time out—a year precisely — as second lieutenant in the field artillery in World War I. Next on to Massachusetts Institute of Technology, where he received his master's degree in electrical engineering in 1922. Mr. Shaw started in business with the public utilities, then with the foundry trade, and in 1938 began his association with the machine tool industry. At Pedrick, he specializes in the design and manufacture of machines to bend metal; holds fifteen patents in this field, and is the author of several technical articles on the subject, his latest being presented in this issue of MACHINERY, page 149. Mr. Shaw has just returned from a summer in Europe where, with pipe in mouth, simply by puffing or not puffing, he coped with all defense de fumer, e vietato fumare, rauchen verboten, and se prohibe fumar signs.

News of the Industry

California

J. K. SUTHERLAND has been reappointed sales manager of the Diamond Machine Tool Co., Los Angeles, Calif., manufacturer of precision metal-working machinery.

Illinois and Indiana

GASTON POWER TOOLS, INC., 14829 Loomis St., Harvey, Ill., manufacturers of heavy-duty grinders and polishers for the metal-working field, have been sold by RALPH M. GASTON to new interests. The firm will be continued under the same name and at the same location. ARTHUR O. BACKEN is the new president.

JOHN S. HAWLEY has been made marketing manager of Shakeproof, Inc., Division of Illinois Tool Works, Chicago, Ill., manufacturer of precision fastening devices for the metal-working industries.

WALTER J. BARZ retired on October 14 as treasurer of Danly Machine Specialties, Inc., Chicago, Ill., manufacturers of die sets and diemakers' supplies and heavy mechanical presses. He will continue, however, to serve as a director of the company. Mr. Barz has been connected with the company ever since it was incorporated in 1923, and was elected treasurer the same year. At the annual meeting of the company, PAUL L. LAWLESS, comptroller, was elected treasurer to succeed Mr. Barz.

Walter J. Barz, who has just retired as treasurer of Danly Machine Specialties

(Left) Ralph G. Lagerfeldt, executive vice-president of Colonial Broach Co. (Right) Harry Gotberg, vice-president in charge of sales engineering, experimental engineering, and estimating

CLIFFORD C. GARRETT, 633 E. 38th St., Indianapolis, Ind., has been appointed sales representative for the KINGSBURY MACHINE TOOL CORPORATION, Keene, N. H., builder of automatic drilling and tapping machines. Mr. Garrett has been a sales engineer for the E. A. Kinsey Co., Indianapolis, Ind., since 1936.

WILLIAM N. OBERLY has been appointed assistant to the manager of manufacturing of the General Electric Co.'s Fractional Horsepower Motor Division, with headquarters at Fort Wayne, Ind. WILLIAM R. BOGGESS has been made assistant manager of sales of the Division.

Michigan

H. H. JASON has been made manager of tool sales and J. D. KENNEDY manager of wear parts sales for the Carboloy Company, Inc., Detroit, Mich. Mr. Jason has been connected with the company since 1946, and Mr. Kennedy since 1948.

RALPH G. LAGERFELDT, vice-president in charge of sales of the Colonial Broach Co., Detroit, Mich., has been named executive vice-president. HARRY GOTBERG, formerly chief engineer, has been made vice-president, and BEN F. WELTE, previously assistant chief engineer, has been advanced to the position of chief engineer. GLEN HARMON succeeds Mr. Welte as assistant chief engineer. Other appointments announced are those of WILLIAM KUKUK as factory manager and HANS REITZ as superintendent of machine construction.

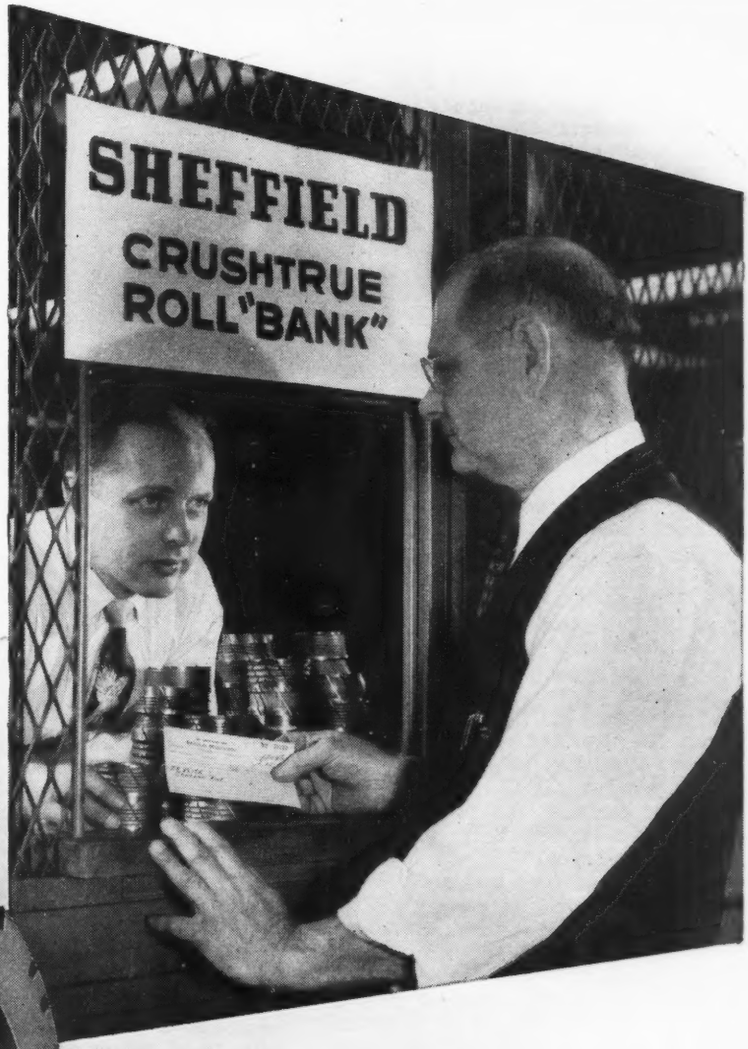
New England

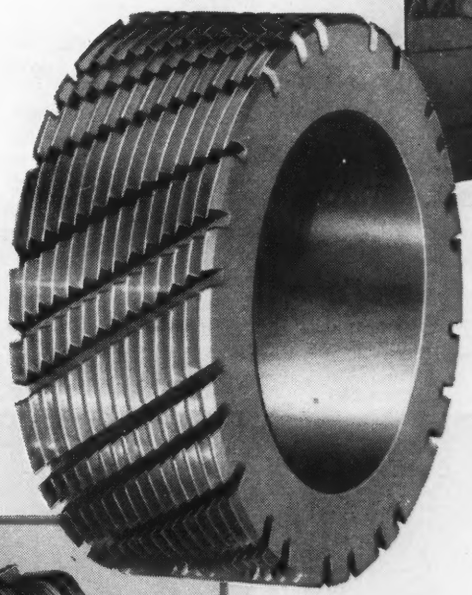
EARLE BUCKINGHAM, professor of Mechanical Engineering at Massachusetts Institute of Technology and author of many articles and several books on gear design, including "Manual of Gear Design," published

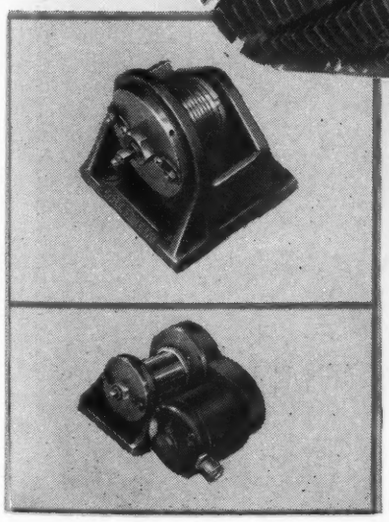
Earle Buckingham, who was presented with the Edward P. Connell Award for his services to the gearing industry

Sheffield Bank

offers you important savings on thread and form grinding







"Withdrawals without waiting—and at a cost of little more than handling charge."

That's the Sheffield Crushtrue Roll Bank service on rolls for crush-dressing grinding wheels for threaded and other profiled work.

Crushtrue Rolls for any standard U.S. thread form 8 to 32 pitch are always "on deposit" awaiting your "withdrawal". Identical service can be arranged for any special thread or other profile.

Only once do you pay the full price for any NEW specific roll. Thereafter, merely return your roll requiring regrinding, a replacement will be shipped usually within 24 hours at a nominal price much lower than the cost of a new roll. This can go on indefinitely, as long as the "depositor" desires.

To enjoy savings and dividends by "opening an account" at Sheffield, let us know of your requirements. Call, wire or write for data on cylindrical and surface Crushtrue grinding equipment.

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GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTACT SERVICES • THREADING TOOLS

by THE INDUSTRIAL PRESS, was presented with the Edward P. Connell Award at the semi-annual dinner of the American Gear Manufacturers Association at the Edgewater Beach Hotel in Chicago on October 24. The Award was made to Professor Buckingham "in recognition of his many years serving the gearing industry as a teacher, student, and author. His work in these fields has had widespread influence on the design, application, and use of gears." This Award was created to commemorate Edward P. Connell, late vice-president and general manager of the Falk Corporation, and is presented annually for meritorious contributions to the advancement of the gearing art, the interests of the American Gear Manufacturers Association, or the gear industry at large.

NORTON Co., Worcester, Mass., has announced the following changes in its Refractories Division: WILLIAM F. WINEMILLER, formerly refractories engineer in the Detroit area, has been named chief sales engineer of the Division, and will be located at the Worcester plant; EUGENE A. FISCHER has been appointed refractories engineer for New England and part of New York State, with headquarters in Worcester; MURNER E. THOR has been assigned the territory consisting of eastern Canada and part of New York State, with headquarters in Buffalo; and DAVID G. BOLON has been named refractories engineer for the principal part of Indiana and the state of Michigan, with the exception of the upper peninsular, his headquarters being in Detroit.

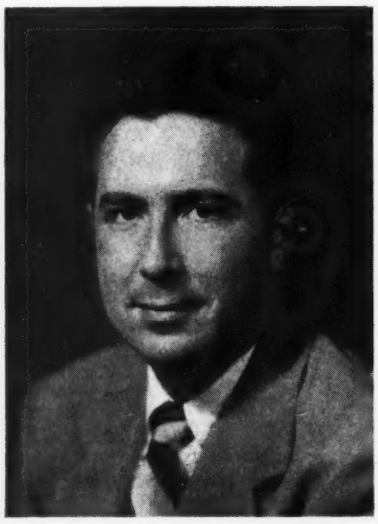
A. L. CARR has been appointed vice-president and director of sales of the Morse Twist Drill & Machine Co., New Bedford, Mass., to succeed J. C. KUHN, who has retired from active business life. C. F. MYERS, formerly Midwest district manager, has been made sales manager, and S. B. LINDH will assume the duties of assistant sales manager.

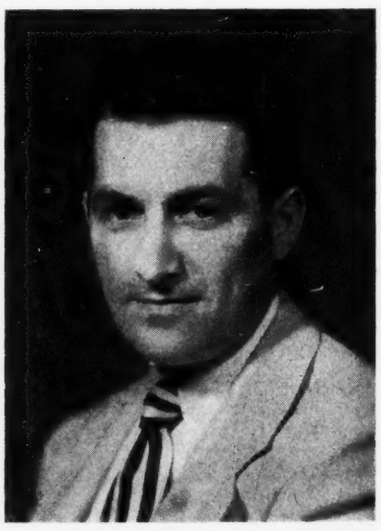
(Left) A. L. Carr, new vice-president and director of sales of the Morse Twist Drill & Machine Co. (Right) C. F. Myers, recently appointed sales manager

ROBERT L. COE, president of Chase Brass & Copper Co., Inc., Waterbury, Conn., has been elected chairman of the board, and will be succeeded as president by RICHARD C. DIEHL, formerly general manager of the Steubenville, Ohio, plants of the Wheeling Steel Corporation.

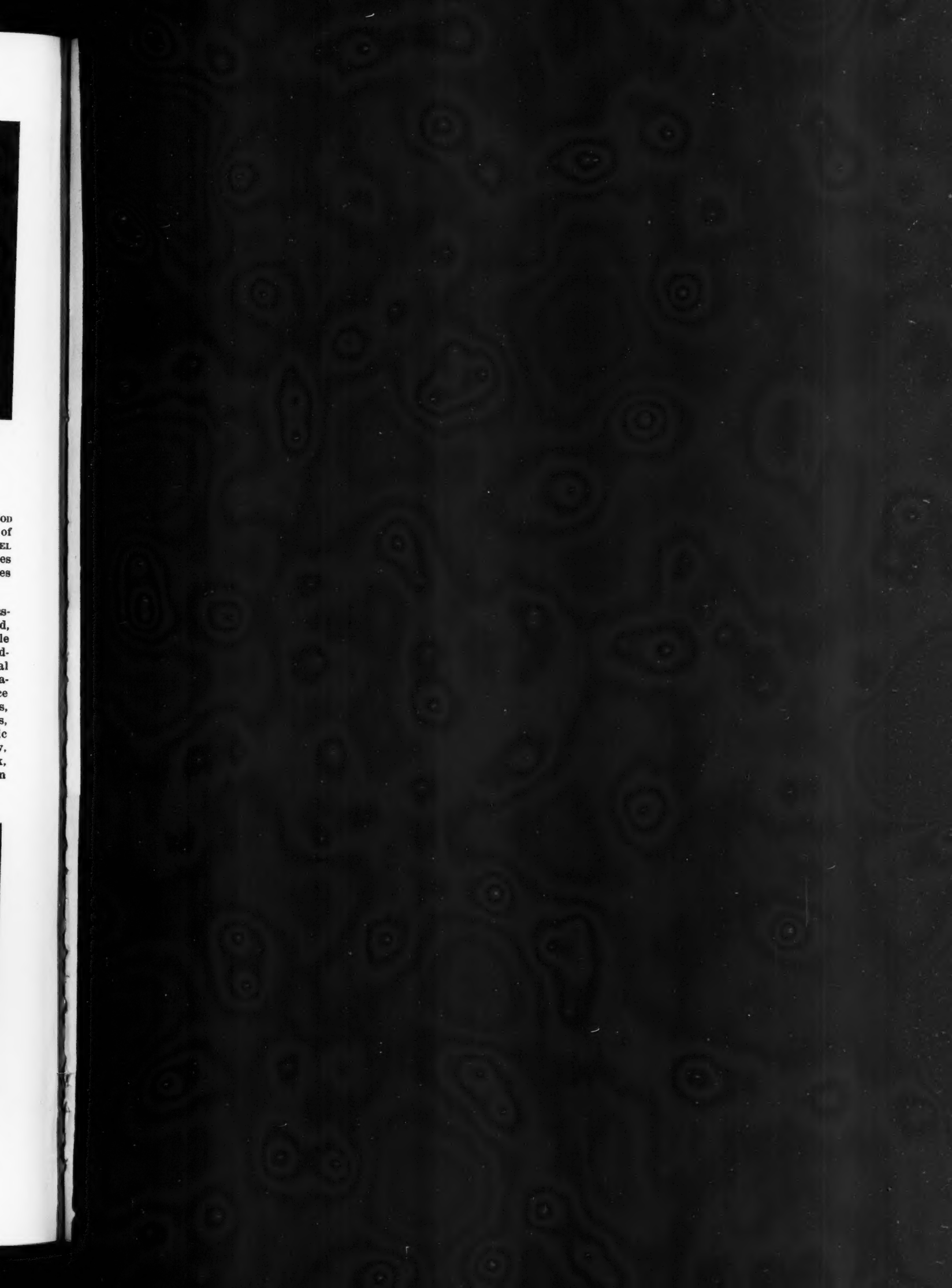
RICHARD SEIPT, who has been vice-president in charge of sales of the Laminated Shim Co., Inc., Glenbrook, Conn., for the last ten years, has been made vice-president and general manager. MERLE L. LOCKWOOD becomes vice-president in charge of sales to succeed Mr. Seipt. MICHAEL E. ERRICO, formerly assistant sales manager, has been appointed sales manager.

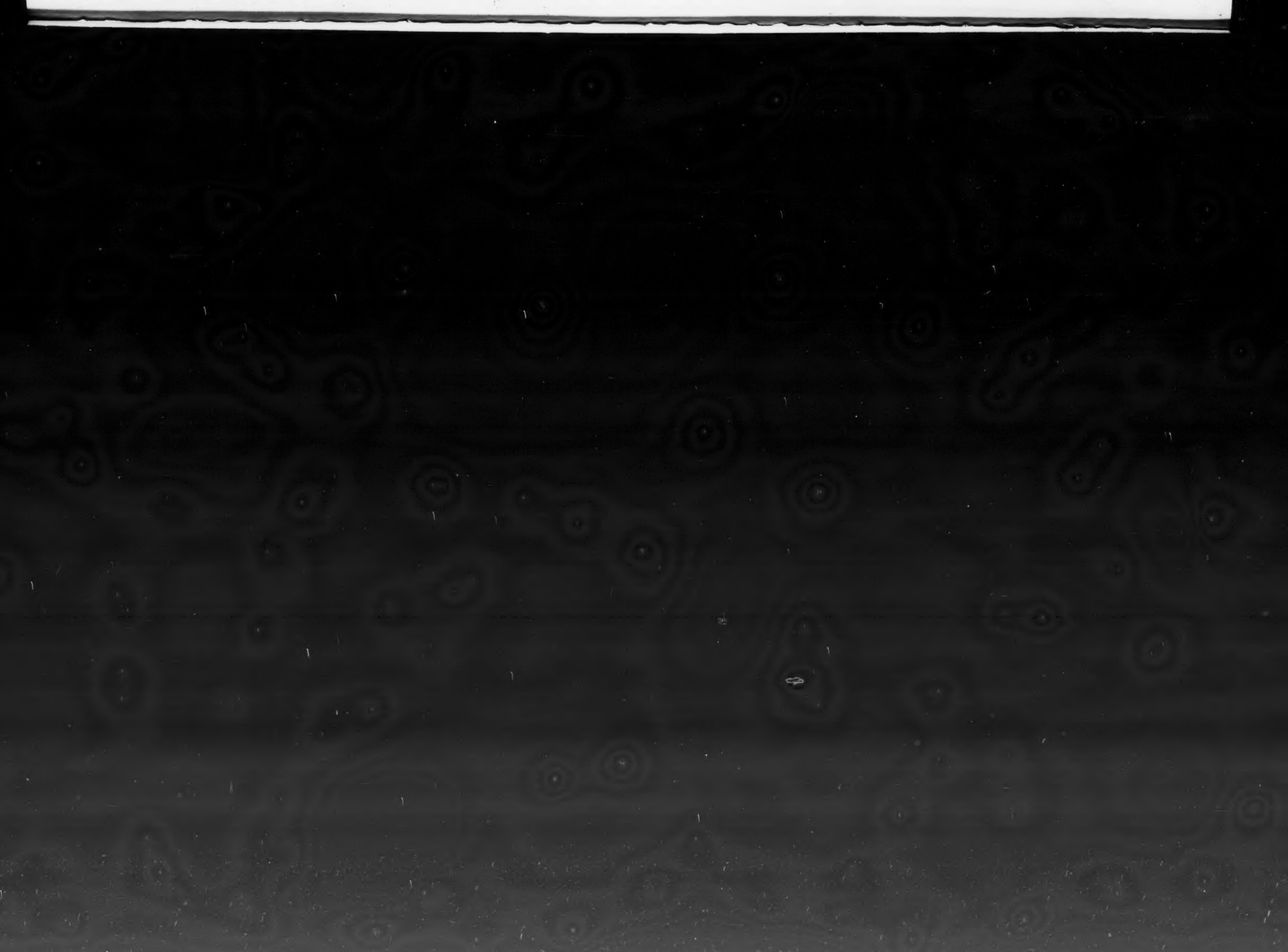
PRATT & WHITNEY DIVISION NILES-BEMENT-POND Co., West Hartford, Conn., has announced it will handle the sales of Steinle centerless thread-rolling machines through its national selling organization. Steinle machines are being used to produce American National Form threads, American standard taper pipe threads, and Acme, Whitworth, and metric threads on a wide variety of hollow, solid, and irregularly shaped work, including studs, bolts, precision screws, aircraft fittings, etc.



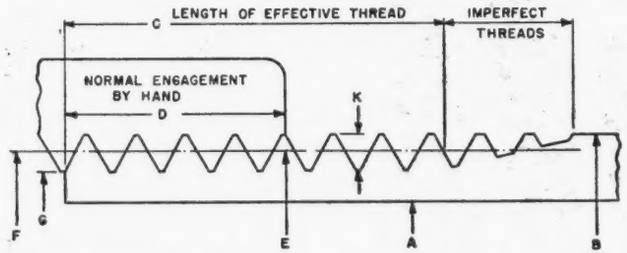


(Left to Right) Richard Seipt, newly appointed vice-president and general manager of the Laminated Shim Co., Inc.; Merle L. Lockwood, who succeeds Mr. Seipt as vice-president in charge of sales; and Michael E. Errico, sales manager





AMERICAN STANDARD TAPER PIPE THREADS (ASA B2.1)—1



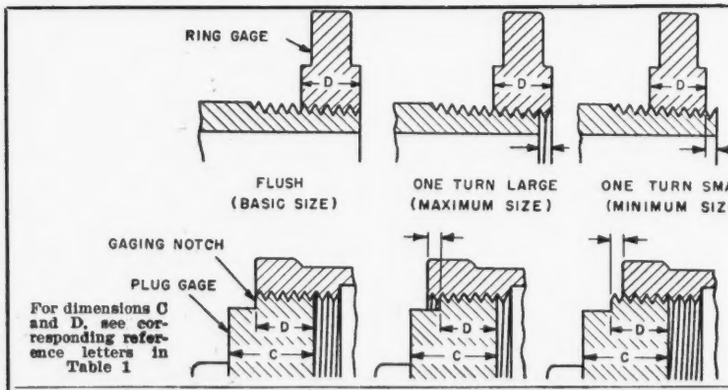
All dimensions in inches.

Angle between sides of thread is 60 degrees. Taper of thread, on diameter, is 3/4 inch per foot.

The basic maximum thread depth K of the truncated thread is 0.8 × pitch of thread. The crest and root are truncated a minimum of 0.033 × pitch for all pitches. Maximum truncation for crest and root is: 0.096 × pitch for 27 threads per inch, 0.088 × pitch for 18 threads per inch, 0.078 × pitch for 14 threads per inch, 0.073 × pitch for 11 1/2 threads per inch, 0.062 × pitch for 8 threads per inch.

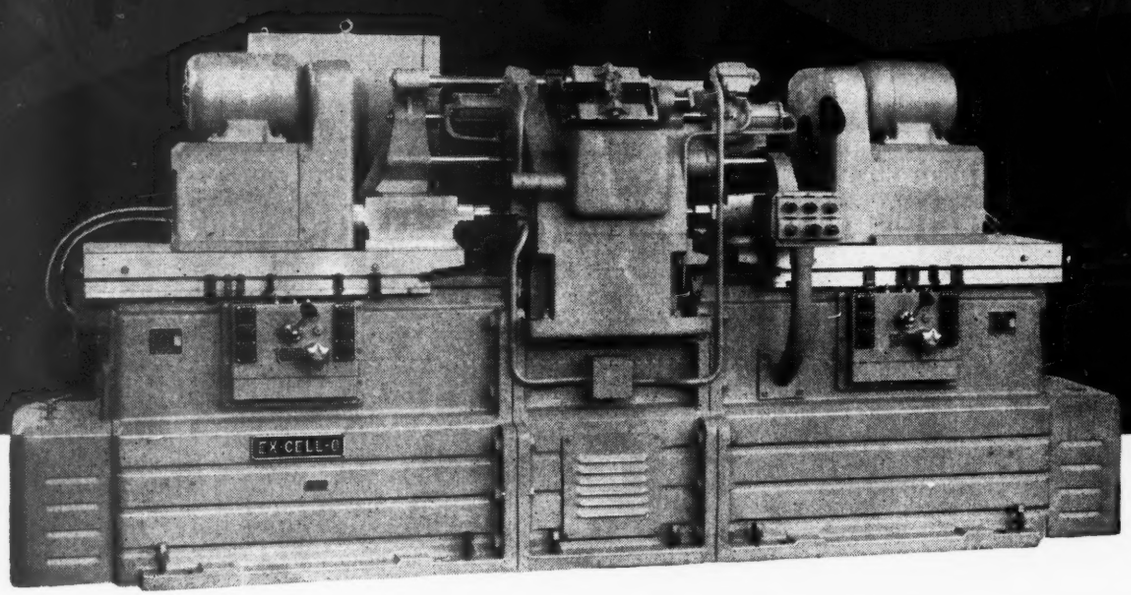
Pipe Size		Number of Threads per Inch	Pitch Diameter		Length of Effective Thread	Length of Hand-tight Engagement	Imperfect Threads	Depth of Thread (Max.)
Nominal Pipe Size	Outside Diameter		At End of External Thread	At End of Internal Thread				
	B		F	E	C	D		K
1/16	0.3125	27	0.27118	0.28118	0.2611	0.160	0.1285	0.02963
1/8	0.405	27	0.36351	0.37476	0.2639	0.180	0.1285	0.02963
1/4	0.540	18	0.47739	0.48989	0.4018	0.200	0.1928	0.04444
3/8	0.675	18	0.61201	0.62701	0.4078	0.240	0.1928	0.04444
1/2	0.840	14	0.75843	0.77843	0.5337	0.320	0.2478	0.05714
3/4	1.050	14	0.96768	0.98887	0.5457	0.339	0.2478	0.05714
1	1.315	11 1/2	1.21363	1.23863	0.6828	0.400	0.3017	0.06957
1 1/4	1.660	11 1/2	1.55713	1.58338	0.7068	0.420	0.3017	0.06957
1 1/2	1.900	11 1/2	1.79609	1.82234	0.7235	0.420	0.3017	0.06957
2	2.375	11 1/2	2.26902	2.29627	0.7565	0.436	0.3017	0.06957
2 1/2	2.875	8	2.71953	2.76216	1.1375	0.682	0.4337	0.10000
3	3.500	8	3.34062	3.38850	1.2000	0.766	0.4337	0.10000
3 1/2	4.000	8	3.83750	3.88881	1.2500	0.821	0.4337	0.10000
4	4.500	8	4.33438	4.38712	1.3000	0.844	0.4337	0.10000
5	5.563	8	5.39073	5.44929	1.4063	0.937	0.4337	0.10000
6	6.625	8	6.44609	6.50597	1.5125	0.958	0.4337	0.10000
8	8.625	8	8.43359	8.50003	1.7125	1.063	0.4337	0.10000
10	10.750	8	10.54531	10.62094	1.9250	1.210	0.4337	0.10000
12	12.750	8	12.53281	12.61781	2.1250	1.360	0.4337	0.10000
14 OD	14.000	8	13.77500	13.87262	2.2500	1.562	0.4337	0.10000
16 OD	16.000	8	15.76250	15.87575	2.4500	1.812	0.4337	0.10000
18 OD	18.000	8	17.75000	17.87500	2.6500	2.000	0.4337	0.10000
20 OD	20.000	8	19.73750	19.87031	2.8500	2.125	0.4337	0.10000
24 OD	24.000	8	23.71250	23.86094	3.2500	2.375	0.4337	0.10000

AMERICAN STANDARD TAPER PIPE THREADS (ASA B2.1)—2



Nominal Pipe Size	Pitch of Thread	Basic Minor Diam. at Small End	Reference, Inspection, and Working Gages					
			Pitch Diam. Tolerance at Gaging Notch	Lead Toler., Plug Gages*	Taper Toler. in Length of Plug Gage†	Taper Toler. in Length of Ring Gage†	Major Diam. Tolerance, Plug Gage‡	Minor Diam. Tolerance, Ring Gage¶
		G	+ or −		+	−	−	+
1/16	0.03704	0.2416	0.0002	0.0002	0.0003	0.0006	0.0004	0.0004
1/8	0.03704	0.3339	0.0002	0.0002	0.0003	0.0006	0.0004	0.0004
1/4	0.05556	0.4329	0.0002	0.0002	0.0004	0.0007	0.0006	0.0006
3/8	0.05556	0.5676	0.0002	0.0002	0.0004	0.0007	0.0006	0.0006
1/2	0.07143	0.7013	0.0003	0.0002	0.0006	0.0009	0.0010	0.0010
3/4	0.07143	0.9105	0.0003	0.0002	0.0006	0.0009	0.0010	0.0010
1	0.08696	1.1441	0.0003	0.0003	0.0008	0.0012	0.0010	0.0010
1 1/4	0.08696	1.4876	0.0003	0.0003	0.0008	0.0012	0.0010	0.0010
1 1/2	0.08696	1.7265	0.0003	0.0003	0.0008	0.0012	0.0010	0.0010
2	0.08696	2.1995	0.0003	0.0003	0.0008	0.0012	0.0010	0.0010
2 1/2	0.12500	2.6195	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
3	0.12500	3.2406	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
3 1/2	0.12500	3.7375	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
4	0.12500	4.2344	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
5	0.12500	5.2907	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
6	0.12500	6.3461	0.0005	0.0004	0.0010	0.0014	0.0016	0.0016
8	0.12500	8.3336	0.0005	0.0004	0.0010	0.0014	0.0020	0.0020
10	0.12500	10.4453	0.0005	0.0004	0.0010	0.0014	0.0020	0.0020
12	0.12500	12.4328	0.0005	0.0004	0.0010	0.0014	0.0020	0.0020
14 OD	0.12500	13.6750	0.0008	0.0005	0.0010	0.0014	0.0030	0.0030
16 OD	0.12500	15.6625	0.0008	0.0005	0.0010	0.0014	0.0030	0.0030
18 OD	0.12500	17.6500	0.0008	0.0005	0.0010	0.0014	0.0030	0.0030
20 OD	0.12500	19.6375	0.0008	0.0005	0.0010	0.0014	0.0030	0.0030
24 OD	0.12500	23.6125	0.0008	0.0005	0.0010	0.0014	0.0030	0.0030

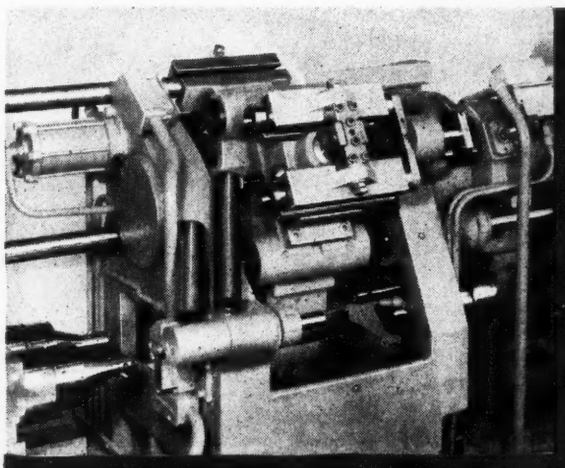
*Lead tolerance for ring gages is 0.0001 inch more than for plug gages.
†Measured along the pitch line in length D with imperfect end threads omitted.
‡The major diameter equals the pitch diameter (F or E) plus 0.666025 × pitch.
¶The minor diameter equals the pitch diameter (F or E) minus 0.666025 × pitch.



EX-CELL-O TWO-WAY MACHINE BORES, CHAMFERS, AND FACES BOTH ENDS OF TUBULAR STEEL PARTS AT NET RATE OF 366 PIECES PER HOUR!

Ex-Cell-O Way Type Precision Boring Machines save time by machining parts from two or more directions at the same time. And relationship of the various operations to one another is exact because the accuracy is built into the machine—it does not depend on the accuracy of repeated locating and clamping.

The machine illustrated here has a trunnion type indexing fixture, machines both ends of two parts per cycle, ejects the finished work automatically. Have your Ex-Cell-O representative explain all the advantages of these machines to you, or write today to Ex-Cell-O in Detroit for further information.



EX-CELL-O CORPORATION

DETROIT 32
MICHIGAN

DS
R!

© Fabian Bachrach

Edmond A. Neal, domestic sales manager of Nicholson File Co.

EDMOND A. NEAL has been appointed domestic sales manager of the Nicholson File Co., Providence, R. I., assuming the duties of HARRY L. WHITNEY, who resigned as director of sales last September. Mr. Neal has been with the company since 1939, and at the time of his promotion was assistant director of sales.

New Jersey

CHARLES BRUNING CO., INC., New York City, manufacturer of blueprint and whiteprint papers and machines, drafting equipment, and technical photographic products, has announced plans for erecting a million dollar plant at the Bergen County Industrial Terminal, Teterboro, N. J. The new Bruning plant will centralize the eastern manufacturing of the company, as well as housing the research organization and executive offices. Sales and service activities will continue to be carried on at 100 Reade St., New York City.

STANLEY M. TRACY recently completed forty years of service with the Driver-Harris Co., Harrison, N. J. Starting as a cost clerk in 1910, he became assistant treasurer in 1918 and was elected treasurer and a director of the company in 1922. In 1938, he was elected executive vice-president.

CHARLES W. FRICK has been appointed works manager of the Propeller Division of the Curtiss-Wright Corporation, Caldwell, N. J.

BIJUR LUBRICATING CORPORATION announces the removal of its headquarters from Long Island City, N. Y., to Rochelle Park, N. J.

New York

OLIVER SMALLEY, president of the Meehanite Metals Corporation, New Rochelle, N. Y., was awarded the Gold Medal of the Gray Iron Founders' Society at the recent annual meeting of the Society in Cincinnati. Mr. Smalley received the award because of his "pioneering work as the first technical director of the Society, his brilliant work to enhance the quality of gray iron castings, and his sound leadership in bringing foundry procedures to a higher state of excellence."

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the purchase of the patents, nane, and technical data of the TURBODYNE CORPORATION, Hawthorne, Calif., a Northrop Aircraft, Inc., research subsidiary that has developed a turboprop aircraft engine believed to be the most powerful propeller type aircraft engine in the world.

HARRY L. ERLICHER recently completed a half century of service with the General Electric Co., Schenectady, N. Y. Starting as a messenger boy fifty years ago, he has become not only a vice-president of the company, but also a key figure in Washington, D. C., where his counsel has often been sought by various agencies.

FRANKLIN HARDWARE CO., New York City, manufacturer of machine shop supplies, aeronautical equipment, hardware, and tools, will celebrate this month its fortieth year in business. The organizers, GEORGE L. BORST and ANDREW DIEHM, are still active in the conduct of the company.

CUMMINS PORTABLE TOOLS DIVISION OF THE AMERICAN SECURITY CORPORATION, Chicago, Ill., has purchased the assets of FRED W. WAPPAT, INC., Mayville, N. Y., manufacturer of portable electric hand saws. The business will be operated in the future as the FRED W. WAPPAT DIVISION.

MAURICE N. TRAINER, first vice-president of the American Brake Shoe Co., New York City, was elected president of the company at a recent meeting of the board of directors, and WILLIAM B. GIVEN, JR., who has been president for twenty-one years, was elected chairman of the board.

FAUSER MACHINE TOOL CORPORATION, 30 Park Ave., Manhasset, N. Y., has been appointed exclusive United States representative for the LEO HJORT CO., Copenhagen, Denmark, manufacturer of keyless, self-centering drill chucks.

FRED P. BIGGS has been appointed president of the Brake Shoe and Castings Division of the American Brake Shoe Co., New York City, and STEPHEN S. CONWAY has been named vice-president in charge of sales.

Pach Bros., N. Y.

Rear Admiral Paul L. Mather, manager of the Precision Equipment Division of the DeLaval Separator Co. and special assistant to the president

REAR ADMIRAL PAUL L. MATHER, USN (Retired), has become associated with the DeLaval Separator Co., New York City, as manager of its Precision Equipment Division and special assistant to the president.

Ohio

M. R. HATCH has been appointed chief engineer in the Press Division of the E. W. Bliss Co., Toledo, Ohio. His primary responsibility will be development and production engineering work on large single-action mechanical presses. Mr. Hatch has

M. R. Hatch, newly appointed chief engineer in the Press Division of E. W. Bliss Co.

had thirty years of experience in the press building industry, most of which has been with the Bliss organization.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces three new expansion programs. The CARLISLE CHEMICAL WORKS, INC., a subsidiary of the company, is moving into its new plant at Reading, Ohio, and expects to be in full operation this fall. A new division of the company has been established known as the CINCINNATI MILLING PRODUCTS DIVISION to sell the new Cincinnati grinding wheels, as well as Cimcool cutting fluid. The plant in which these products are made, which was completed only about a year and a half ago, is now being enlarged. In addition, plans have been made to erect a new machine tool plant within easy reach of Cincinnati on a site just outside of Wilmington, Ohio, on which construction is to be started in the near future.

ARO EQUIPMENT CORPORATION has acquired the business and assets of the TAYLOR MACHINE CO., Cleveland, Ohio. Aro aircraft accessories, formerly manufactured at the main plant of the company in Bryan, Ohio, will be produced at the new plant, which is to be known as the ARO EQUIPMENT CORPORATION AIRCRAFT DIVISION. JAMES P. JOHNSON, a former executive of the Aro Equipment Corporation, has been named vice-president in charge of the new division. A. N. ABELSON is works manager.

ROBERT F. GOLDEN has been appointed works manager for the Reliance Division of the Eaton Mfg. Co., Massillon, Ohio, and C. A. SELLEN has been made assistant to the general manager. Mr. Golden joined the Reliance Division in May, 1946, while Mr. Sellen became connected with the Division in 1939.

SHERMAN S. CROSS has been appointed operations manager of the Brainard Steel Co., Warren, Ohio, succeeding J. HOWARD PATTON, who recently resigned. Mr. Cross became associated with the company in 1949 as chief product engineer.

D. W. HOLMES, for four years general sales manager of the Parker Appliance Co., Cleveland, Ohio. manufacturer of aircraft and industrial tube fittings, valves, and other hydraulic equipment, has been elected vice-president in charge of sales.

WILLIAM A. BOHLANDER has been appointed factory manager of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. He was previously superintendent of the Aetna Standard Engineering Co., Youngstown, Ohio.

CARL F. HERBOLD has recently been appointed director of manufacturing planning for the Small Motor Division of the Westinghouse Electric Corporation at Lima, Ohio.

Oklahoma and Arkansas

P. J. GALLAGHER has been appointed general sales manager of the Hinderliter Tool Co. Division of H. K. Porter Co., Inc., Tulsa, Okla. The products of this division of the company consists of oil-well drilling equipment, valves, and air-brake parts.

WESTINGHOUSE ELECTRIC CORPORATION is planning to add a 100,000 square foot wing to its lamp plant in Little Rock, Ark. This addition will increase the floor space by two-thirds and will enable the plant to be operated at full capacity.

Pennsylvania

WILLIAM L. BATT, SR., president of S K F Industries, Inc., Philadelphia, Pa., and former vice-chairman of the War Production Board, has been appointed chief of the Economic Cooperation Administration mission to the United Kingdom, succeeding W. JOHN KENNEY.

S K F INDUSTRIES, INC., Philadelphia, Pa., is expanding the production facilities of its ball and roller plant in order to keep pace with the increased demands for anti-friction bearings. The new addition will provide more than 40,000 square feet of floor space.

REED ROLLER BIT CO., CLECO DIVISION, Houston, Tex., has appointed the ENSMINGER CO., 57 Wood St., Wilkes-Barre, Pa., distributor of Cleco pneumatic tools.

YALE & TOWNE MFG. CO., New York City, has announced several changes in the organization. Ellis H. Jones has retired as general manager of the Canadian Division of the company after fifty-seven years of service, and is succeeded by GEORGE L. DIRKS. In the Philadelphia Division, JAMES P. KINNEY has been appointed general sales manager to succeed SAMUEL W. GIBB; JAMES A. SHELLENBERGER has been named director of advertising, publicity, and market research; JOHN T. MCCARLEY has been made manager of production; C. EUGENE MOORE has been appointed

Blank & Stoller

(Left to Right) James P. Kinney, general sales manager of the Philadelphia Division, Yale & Towne Mfg. Co.; James A. Shellenberger, director of advertising, publicity, and market research; and C. Eugene Moore, newly appointed works manager

✻ REVERE COPPER AND BRASS *HELPS*

keep TV Sales Hot

FOR

~~CROSLEY~~

...makes Cabinets Cool and Classy

The newest Crosley Television Cabinets are striking examples of how copper and brass can be used to give products sales appeal as well as serve a utilitarian purpose.

All models, two of which are shown above, are equipped with gleaming bezels which frame the television screens. They are made for the Crosley Corporation from Revere 90-10 Commercial Bronze. The table model shown is equipped with two control escutcheons drawn from this same metal by the Rex Engineering Company, Cincinnati, Ohio. The table model also has two strips of .0016" Revere Soft Copper of 5½" width on the under side of the top of the cabinet. This acts as an insulator by conducting any heat generated, away from the wooden cabinets. For, although copper is the best heat conductor of the commercial metals, when highly polished it dissipates rather than absorbs heat.

Note on the console model, shown above, how the three Revere Brass Tubes add a touch of luxury and richness to the cabinet.

Perhaps Revere Copper or Brass or one of its other metals or alloys can help in the development and improvement of your product. Why not call the nearest Revere Sales Office and see?

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere

works manager; and BRUNO A. MOSKI has been named to the new post of chief industrial engineer.

Wisconsin

WARNER ELECTRIC BRAKE MFG. CO., Beloit, Wis., announces that the name of the company has been changed to the WARNER ELECTRIC BRAKE & CLUTCH CO. in order to more closely associate the name with the company's full scope of operations.

Obituaries

Ransford V. Mann

Ransford V. Mann, vice-president in charge of sales of the Carpenter Steel Co., Reading, Pa., died on September 26 in St. Joseph's Hospital in Reading at the age of sixty-two years. Mr. Mann was born in Jericho, L. I., in 1888. He was the son of the late Dr. John Mann, one of the founders of Nassau Hospital at Mineola, L. I.

After completing his early education in the Friends School at Locust Valley, he entered Stevens Institute of Technology, from which he graduated in 1911. The same year he went to work for the Carpenter Steel Co. as a sales trainee. Four years later, he entered military service, and served as captain in Army Ordnance during World War I. Following the war, he returned to the sales department of the Carpenter Steel Co.

Mr. Mann was widely known as an authority on stainless steel. Through the years he assumed positions of greater responsibility in the company until, in 1941, he was appointed general sales manager. In 1948, he became vice-president in charge of sales. Mr. Mann was a member of the American Iron and Steel Institute and a trustee of the St. Joseph's Hospital.

Ransford V. Mann

Ernest S. McClary

Ernest S. McClary, secretary and treasurer of E. W. Bliss Co., Toledo, Ohio, died of a heart attack on September 23 at his summer home in Huntington, L. I. Mr. McClary had been associated with the Bliss organization for the last seventeen years. He was also a director of the H. & B. American Machine Co., Pawtucket, R. I.

Ernest S. McClary

A. OAKLEIGH BUSH, chief sales engineer of the Abrasive Division of the Norton Co., Worcester, Mass., died suddenly at his home on September 2. Mr. Bush began his association with the Norton organization in 1924 at the research laboratory in the Niagara Falls plant soon after his graduation from Massachusetts Institute of Technology. Since 1928, he had been in the company's sales departments, being appointed assistant chief sales engineer in 1940, and four years later, chief sales engineer. During his career, Mr. Bush was responsible for a number of improvements in the manufacture of abrasive products.

JOSEPH A. HORNE, chairman of the board of directors of the Yale & Towne Mfg. Co., New York City, died on October 3 in Stamford, Conn., after a brief illness at the age of eighty-two years. Mr. Horne was associated with Yale & Towne for fifty-eight years, starting in 1892 as a foreman, and rising to become acting president during World War I and vice-president in charge of production from 1920 to 1943. Since then, he had been chairman of the board. Mr. Horne was a member of the American Society of Mechanical Engineers. He is survived by his wife.

EARLE S. HENNINGSEN, manager of engineering of the General Electric Co.'s Large Motor and Generator Divisions at Schenectady, N. Y., died in Easton, Md., on September 23 after a brief illness, at the age of sixty years. Mr. Henningsen was a pioneer in the development of alternating-current machinery. He had been with the company for thirty-eight years and was planning to retire on October 1. Mr. Henningsen was a member of the Society of Professional Engineers and a fellow of the American Institute of Electrical Engineers.

W. B. HORTON, welding engineer for the Lincoln Electric Co. in Chicago, Ill., died on September 19 at the age of 53 years. Mr. Horton started working for the company in 1929 in Chicago. Prior to his connection with the Lincoln organization, he worked for the Bristol Co. in Waterbury, Conn., the Halle Bros. Co. in Cleveland, Ohio, and several concerns in Chicago. He was a member of the American Welding Society.

WILLIAM R. REID, chairman of the board of the Torrington Co., died on September 16, at Torrington, Conn., following a short illness. He was seventy-one years of age. Mr. Reid had been with the company for fifty years, twenty-two of which he had served as president. For the last four years, he had been chairman of the board. Surviving are his wife and a son, William R. Reid, Jr.

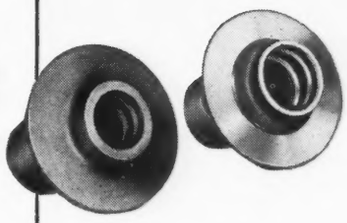
GEORGE C. ADAMS, sales representative for Joseph T. Ryerson & Son, Inc., in the Chicago metropolitan area, died on September 14 at the age of fifty-nine years. He had been connected with the company for thirty-eight years, and was one of the oldest members in point of service on the Ryerson sales staff. Mr. Adams had a very wide circle of friends in the steel industry.

* * *

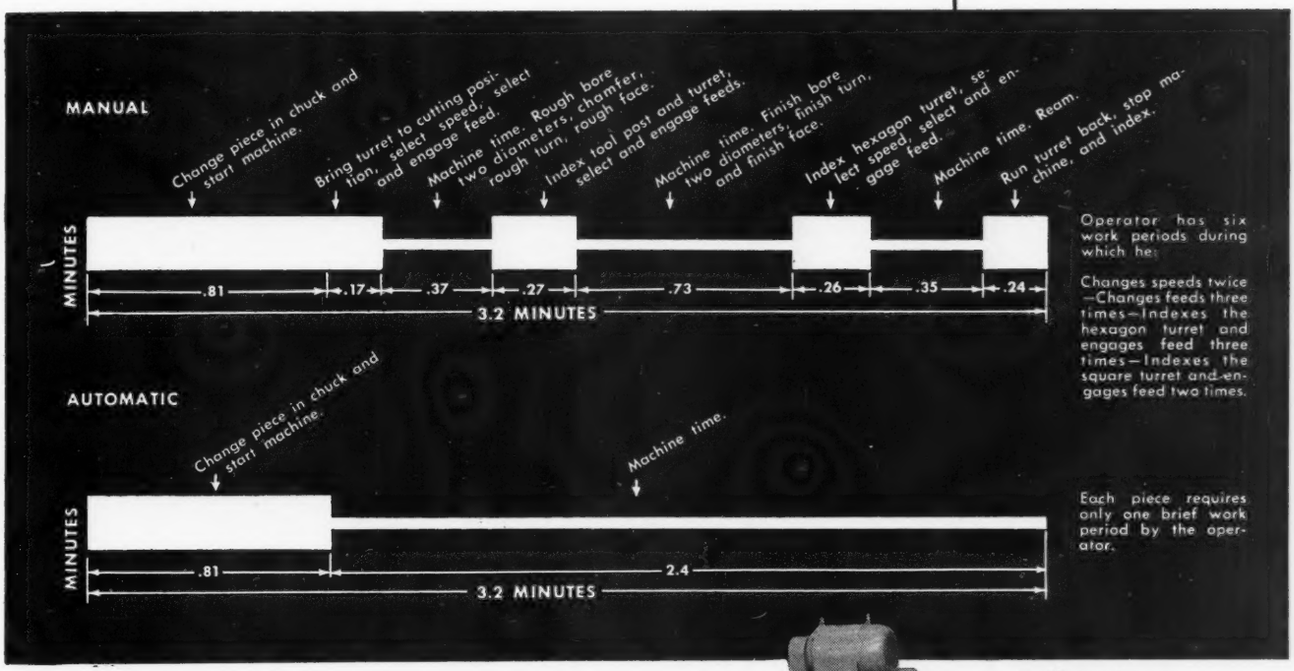
Motion Picture Shows Making of Steel

A color and sound motion picture that explains the making of steel, from the mining or iron ore and coal to the rolling of semi-finished and finished products, has been made available for group showings. This 16-millimeter, 22-minute film, entitled "Strength in the West," can be obtained by writing to the Public Relations Department, Kaiser Steel Corporation, 1924 Broadway, Oakland 12, Calif. Requests should be submitted approximately ten days in advance of the intended showing date.

how the
GISHOLT FASTERMATIC
saves man-minutes and money!



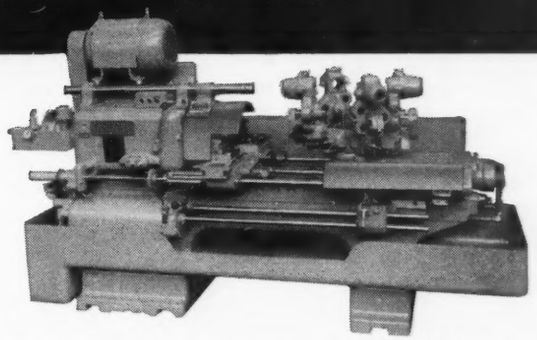
Here is an actual comparison of the time and work cycle of a manually operated turret lathe and a Gisholt Fastermatic Automatic Turret Lathe. The machining of wheel hubs, shown above, requires 6 operations as follows: rough bore, finish bore, ream, rough face, finish face and chamfer. Note that the manually operated machine takes over 54% of the operator's time whereas the Fastermatic takes only 25% of his time, leaving 75% without interruption.


MANUAL
Change piece in chuck and start machine.
Bring turret to cutting position, select speed, select and engage feed.
Machine time. Rough bore two diameters, chamfer, rough turn, rough face.
Index tool post and turret; select and engage feeds.
Machine time. Finish bore two diameters, finish turn, and finish face.
Index hexagon turret, select speed, select and engage feed.
Machine time. Ream.
Run turret back, stop machine, and index.
MINUTES
.81
.17
.37
.27
.73
.26
.35
.24
3.2 MINUTES
Operator has six work periods during which he:
Changes speeds twice —Changes feeds three times—Indexes the hexagon turret and engages feed three times—Indexes the square turret and engages feed two times.
AUTOMATIC
Change piece in chuck and start machine.
Machine time.
MINUTES
.81
2.4
3.2 MINUTES
Each piece requires only one brief work period by the operator.

That's the story of the Fastermatic in a nutshell—less work time for the operator. The Fastermatic handles all changes of feeds and speeds automatically.

In this case, for example, the other side of the work piece is done by another Fastermatic with substantially the same cycle. One operator keeps both machines constantly under cut and still has ample time for stacking and work inspection. Important, too, is the fact that both Fastermatics are tended by a comparatively unskilled operator.

There are many such cases where Fastermatics can cut costs substantially. Gisholt engineers will gladly answer your questions. Write us.



THE GISHOLT 1-F FASTERMATIC—*smallest of 3 different sizes which enable you to machine a maximum number of surfaces in one chucking, handling all changes in speed and feed automatically. On this job, turret was double-tooled so that two parts were completed with each revolution of the turret. Ask for literature.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Coming Events

NOVEMBER 8-11—Annual convention of the manufacturers of Meehanite castings at the Hotel Knickerbocker, Chicago, Ill., under the auspices of the Meehanite Metal Corporation, New Rochelle, N. Y.

NOVEMBER 14-16—TECHNICAL CONFERENCE OF THE MACHINE TOOLS SUBCOMMITTEE of the A.I.E.E. Committee on General Industries Applications at the Sheraton Hotel in Worcester, Mass., under the auspices of the Worcester Section of the American Institute of Electrical Engineers. Further information can be obtained from G. R. Blake, Westinghouse Electric Corporation, 507 Main St., Worcester 8, Mass.

NOVEMBER 27-DECEMBER 2—NINETEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York 17, N. Y., in conjunction with the annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary of A.S.M.E., Clarence E. Davies, 29 W. 39th St., New York 18.

JANUARY 15-18, 1951—SECOND PLANT MAINTENANCE SHOW AND CONFERENCE at the Auditorium, Cleveland, Ohio. For further information, address Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MARCH 19-23, 1951—WESTERN METAL CONGRESS AND EXPOSITION at the Civic Auditorium, Oakland, Calif. Sponsored by the American Society for Metals. National secretary, William H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 23-26, 1951—Fifty-fifth annual convention of AMERICAN FOUNDRYMEN'S SOCIETY in Buffalo, N. Y. Secretary-treasurer, William W. Maloney, 616 S. Michigan Ave., Chicago 5, Ill.

APRIL 30-MAY 4, 1951—FOURTH NATIONAL MATERIALS-HANDLING EXPOSITION in the International Amphitheatre, Chicago, Ill. Sponsored by the Materials Handling Institute. Further information can be obtained from the exposition management, Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

MAY 23-24, 1951—Fifth annual convention of the AMERICAN SOCIETY FOR QUALITY CONTROL in Cleveland, Ohio; headquarters, Hotel Cleveland. For further information, address John F. Occasione, Publicity Chairman, American Society for Quality Control, care of American Steel & Wire Co., 1406 Rockefeller Bldg., Cleveland 13, Ohio.

New Books and Publications

TREATISE ON POWDER METALLURGY, Volume 2. By Claus G. Goetzel. 910 pages, 6 by 9 inches. Published by Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. Price, $18.

This is the second volume of a comprehensive treatise on the subject of powder metallurgy, covering both the theory and practice of this comparatively new process. The first volume, which was reviewed in these columns in June, 1949, dealt with the technology of metal powders and their products, covering the history, methods of producing and testing powders, molding of powders and equipment employed, hot-pressing techniques, sintering practices, and finishing treatments.

The present volume is devoted to applied and physical powder metallurgy. In the first section—applied powder metallurgy—are discussed refractory metals and alloys; hard metals and compositions; electrical materials and products; magnetic materials and products; ferrous and non-ferrous materials for structural parts; porous products; friction products; dental alloy; and miscellaneous applications for metal powders. Manufacturing methods; powder production; pressing and sintering; properties; and industrial applications are treated. The author has made a careful study of the literature on the subject, and the book is replete with references to books containing supplementary information.

Part 2 of the book, dealing with physical powder metallurgy, gives practical evaluations and theoretical analyses of the materials, products, and processes. A comparison of the physical properties of sintered and fused industrial metals and alloys is made; a survey of sintered metals and alloys for potential and industrial use is presented; stress analysis of sintered metal structures is discussed; various testing methods for sintered metals are described and evaluated; and the many different theories of bonding and sintering are summarized. In the final chapter, the future of powder metallurgy is discussed, particularly as regards high-temperature service applications.

From the foregoing description of the contents, it will be evident that this work should be of especial value to development engineers as a source for new applications.

PROCEDURE HANDBOOK OF ARC-WELDING DESIGN AND PRACTICE. 1200 pages, 6 by 9 inches; 1300 illustrations. Published by the Lincoln Electric Co., Cleveland 1, Ohio. Price, $2 in the United States; $2.50 elsewhere.

The new ninth edition of this well-known handbook on arc welding design and practice has been completely revised to bring all information up to date and include recent important developments. New design data has been included to make the book more helpful to designers of welded machines and structures. The latest procedures are given for welding metals and alloys by the manual open-arc and hidden-arc processes, as well as by automatic and semi-automatic hidden-arc methods. A new chapter on weldability contains information gathered from research projects and recent studies on welding procedures for many different types of metals.

The section on structural design has been enlarged and revised, and the machine design information has also been expanded to include more information on the welded design of machine tools. Included in the new material is a chapter presenting the fundamentals of welded design for both machinery and structures. Stress allowables are given which can be applied to particular design problems. Other sections of the book deal with techniques, procedures, speeds, and costs for welding mild steel; inspection and testing of weld metal; and miscellaneous applications of arc welding in manufacture, construction, and maintenance.

HIGH-FREQUENCY INDUCTION HEATING. By Frank W. Curtis. 389 pages, 5 1/2 by 8 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.

This book, which is now in the second edition, outlines the fundamental electrical principles involved in high-frequency induction heating; defines the range and scope of this process; describes design of induction-heating coils; and discusses many applications of induction heating to such specific problems as the hardening of metal parts, joining of metal assemblies, and similar operations. New material on fixture designs has been added in the present edition, and types of steels best suited to induction hardening, quenching methods, and soldering and brazing alloys are all treated in greater detail.

INVOLUTE SPLINES AND SERRATIONS (SAE Standard, Approved January, 1950). 89 pages, 8 1/2 by 11 inches. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. Price, $1.50 to members of the Society, $3 to nonmembers.